Instructions : W 460/103

BOSCH system and : Mechanical load impact damping (MLD)

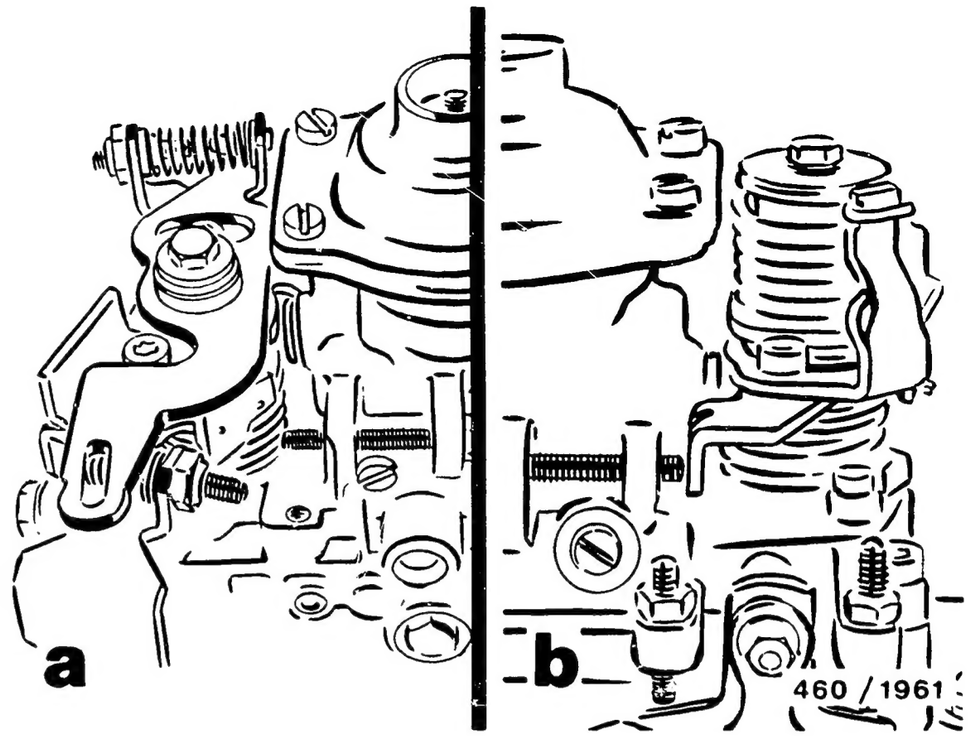
spring-type load impact damping (FLD)

for distributor-type fuel-injection pump (VE)

Basic microcard : W 460/100








Pump with MLD – picture a
Pump with FLD – picture b

## SPECIAL FEATURES

This microcard deals with the repair of distributor-type fuel-injection pumps with:

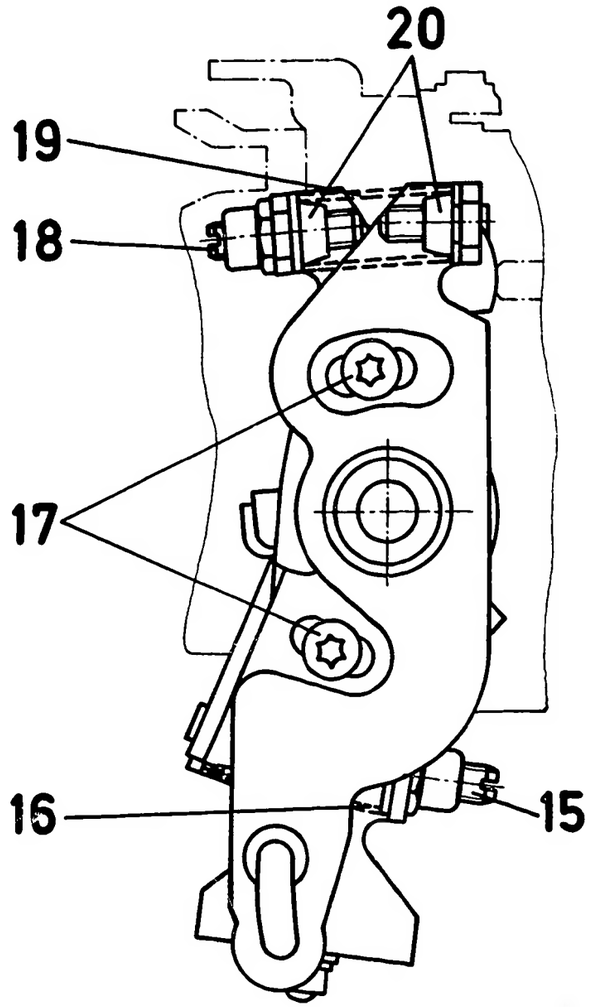
-Mechanical load impact damping (MLD)
-Spring-type load impact damping (FLD)

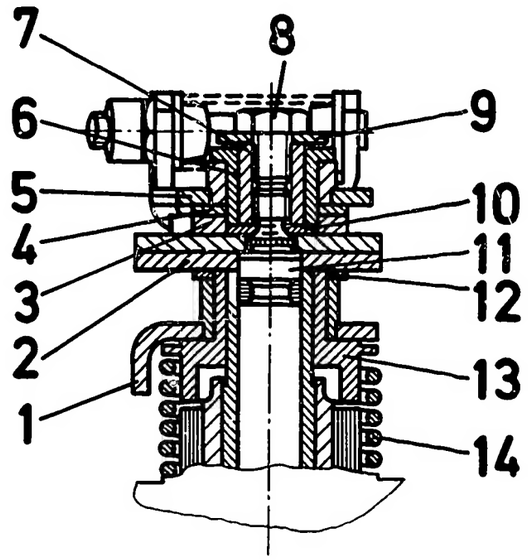
It is based on the detailed repair instructions W-460/100.

## TEST SPECIFICATIONS

-Pre-adjustment dimensions:

| | |
|---|---|
| Idle-motion-spring dimension (corresponds to 3.0 mm between adjusting lever and control lever). | 4.0 mm |
| Damping travel | min. 5.0 mm |

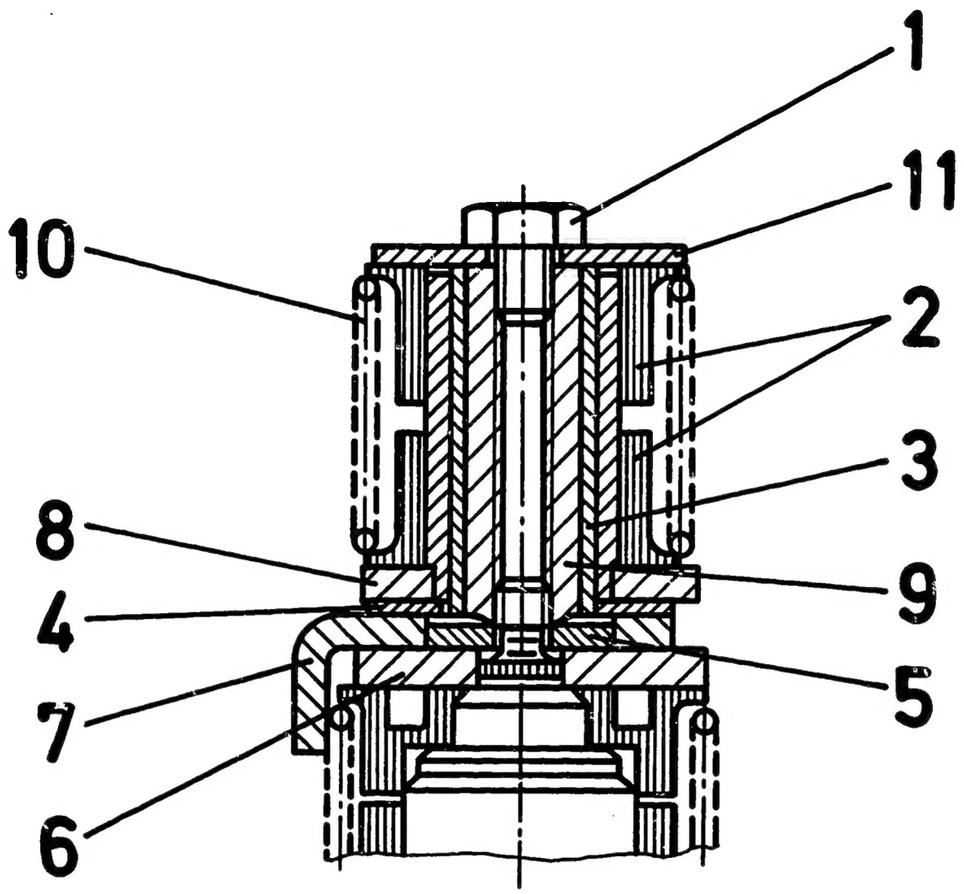



460/1962

1 = Intermediate lever
2 = Clamping lever
3 = Adjusting lever
4 = Plain washer
5 = Control lever
6 = Intermediate bushing
7 = Connecting nut
8 = Hexagon nut
9 = Plain washer
10 = Shim
11 = Part-load regulator
12 = Plain washer
13 = Spring seat
14 = Cylindrical helical coiled spring
15 = Headless set screw
16 = Compression spring
17 = Torx bolt
18 = Headless set screw
19 = Compression spring
20 = Spring seat

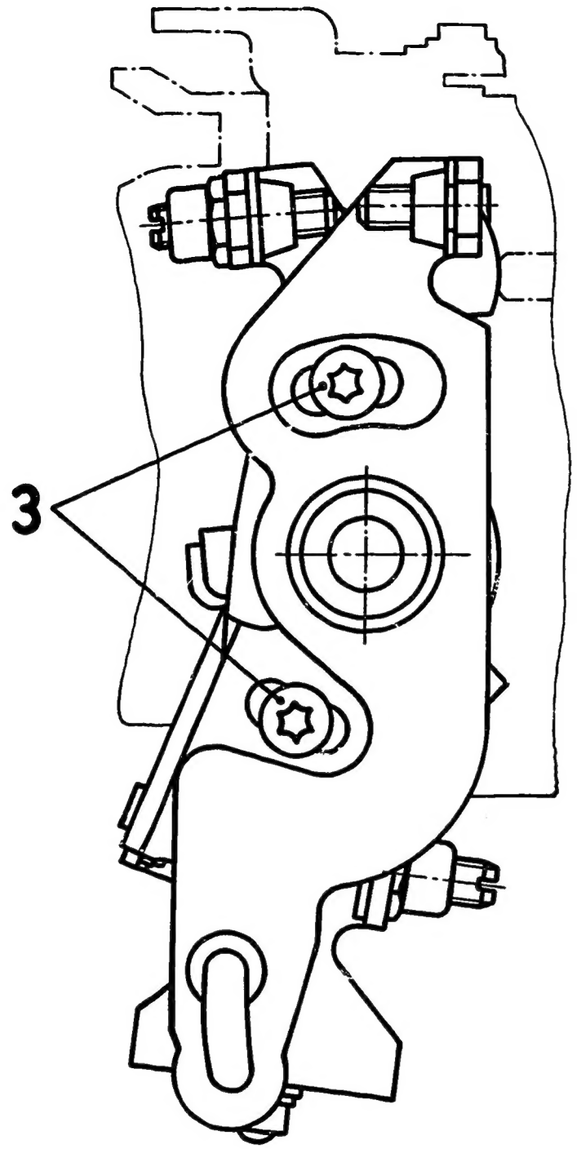
INDIVIDUAL COMPONENTS OF MECHANICAL LOAD IMPACT DAMPING (MLD)

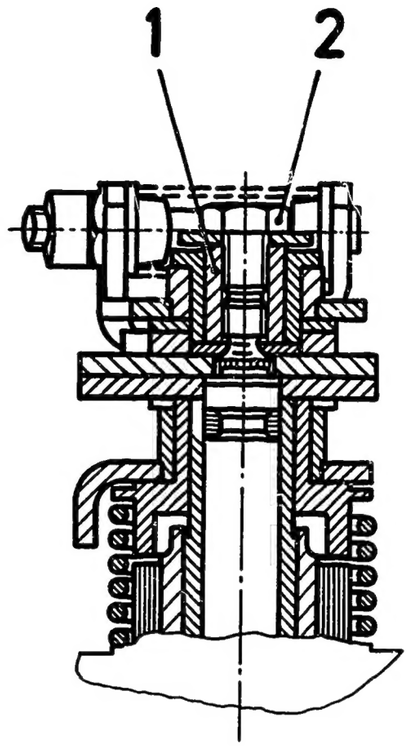



460/1963

1 = Hexagon bolt
2 = Spring seat
3 = Intermediate bushing
4 = Plain washer
5 = Plain washer
6 = Positioning lever
7 = Adjusting lever
8 = Control lever
9 = Connecting nut
10 = Cylindrical helical coiled spring
11 = Plain washer

INDIVIDUAL COMPONENTS OF SPRING-TYPE LOAD IMPACT DAMPING



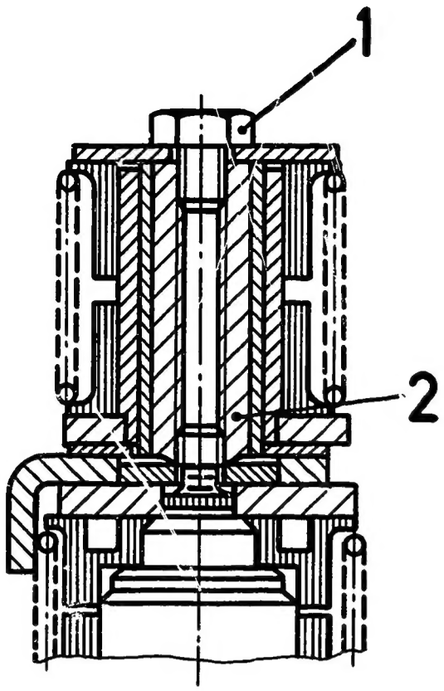




460/1964

1 = Connecting nut 6.0...10.0 Nm
2 = Hexagon bolt 2.5... 4.5 Nm
3 = Torx fillister-head screw 10.0...14.0 Nm

TIGHTENING TORQUES – pump with mechanical load impact damping
N o t e :
Always comply with tightening torques. If the hexagon bolt is tightened more than the connecting nut, the entire lever assembly will be loosened on subsequent disassembly (due to loosening of connecting nut). The pre-tensioned compression springs between the levers may spring off in an uncontrolled manner.

A07 — ⟹
A08 — ⟺




460/1965

1 = Connecting nut 6.0...10.0 Nm
2 = Hexagon bolt 2.5...4.5 Nm

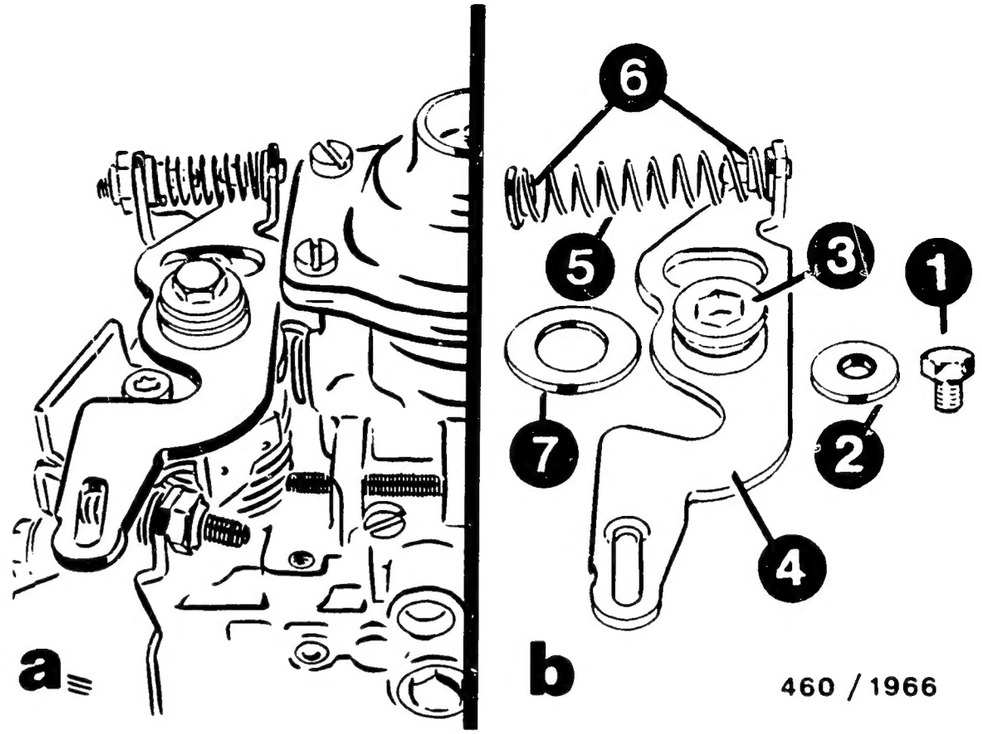
–Pump with spring–type load impact damping

N o t e :

Always comply with tightening torques.

If the hexagon bolt is tightened more than the connecting nut, the entire lever assembly will be loosened on subsequent disassembly (due to loosening of connecting nut).

The pre–tensioned compression springs between the levers may spring off in an uncontrolled manner.




460 / 1966

1 = Hexagon nut
2 = Plain washer
3 = Intermediate bushing
4 = Control lever
5 = Idle–motion spring
6 = Spring seat
7 = Plain washer

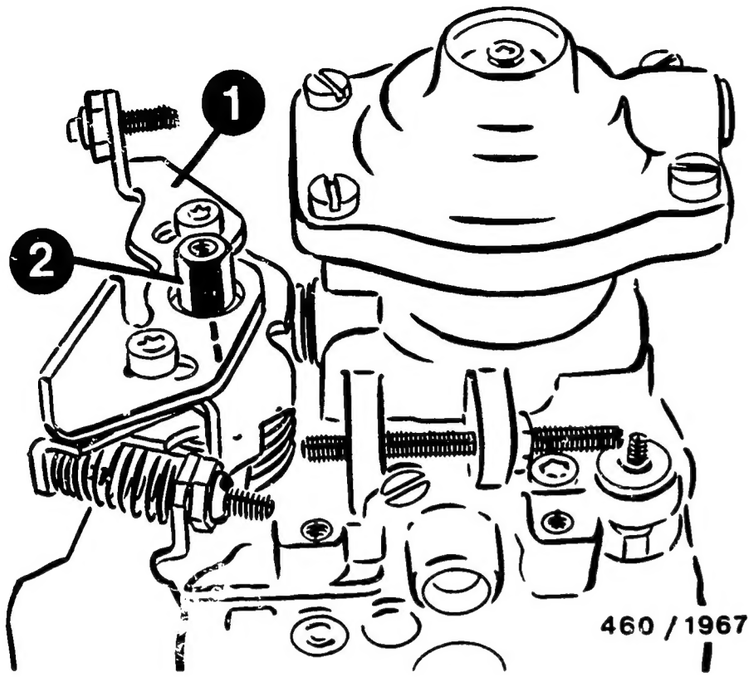
REMOVAL OF LEVER ASSEMBLY

1. Pump with mechanical load impact damping (MLD)

Remove hexagon nut and plain washer.

Remove intermediate bushing, control lever and idle–motion spring with spring seat.

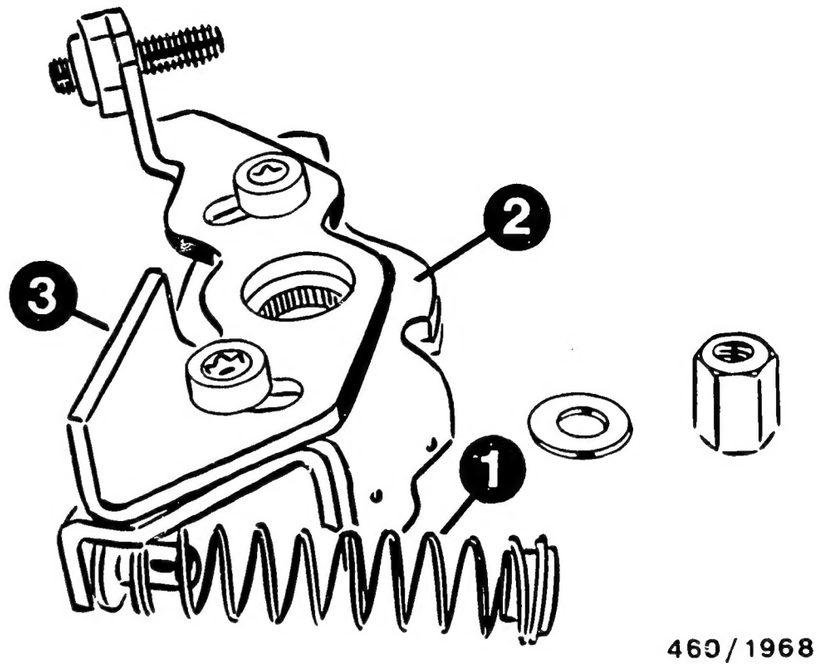
Remove plain washer.




1 = Adjusting lever
2 = Connecting nut

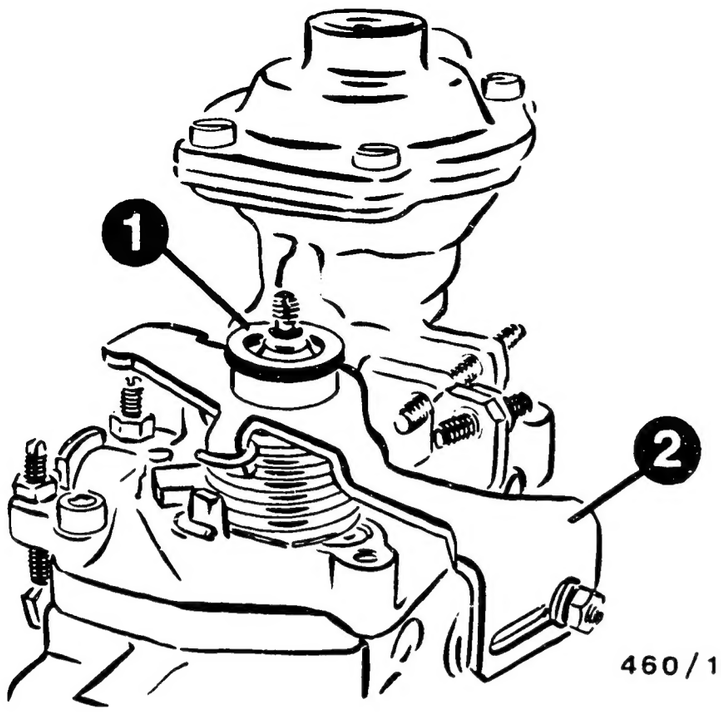
Mark adjusting lever and setting shaft with respect to one another.

Remove connecting nut with shim.




1 = Compression spring (damping spring)
2 = Clamping lever
3 = Adjusting lever

Remove clamping lever together with adjusting lever, compression spring (damping spring) and spring seat.




460/1969

1 = Plain washer
2 = Intermediate lever

Remove plain washer from intermediate lever.

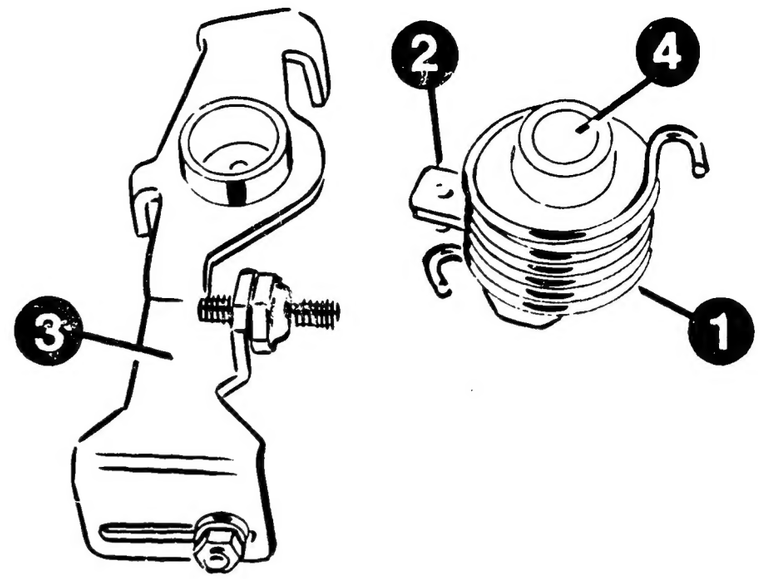
Disengage cylindrical helical coiled spring.

Remove intermediate lever.

Remove upper spring seat from setting-shaft mount.

Remove cylindrical helical coiled spring together with lower spring seat.






460/1970

1 = Cylindrical helical coiled spring
2 = Lower spring seat
3 = Intermediate lever
4 = Upper spring seat

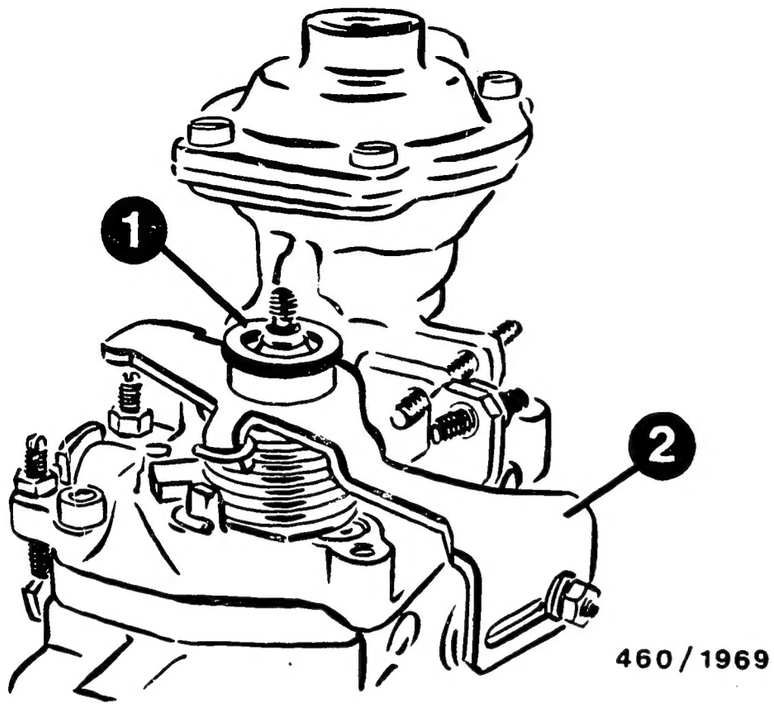
ASSEMBLING LEVER ASSEMBLY

N o t e :

Plastic parts must be easy to assemble.

Attach cylindrical helical coiled spring with lower/upper spring seat to setting-shaft mount. Slip intermediate lever on to upper spring seat. Ensure freedom of movement.

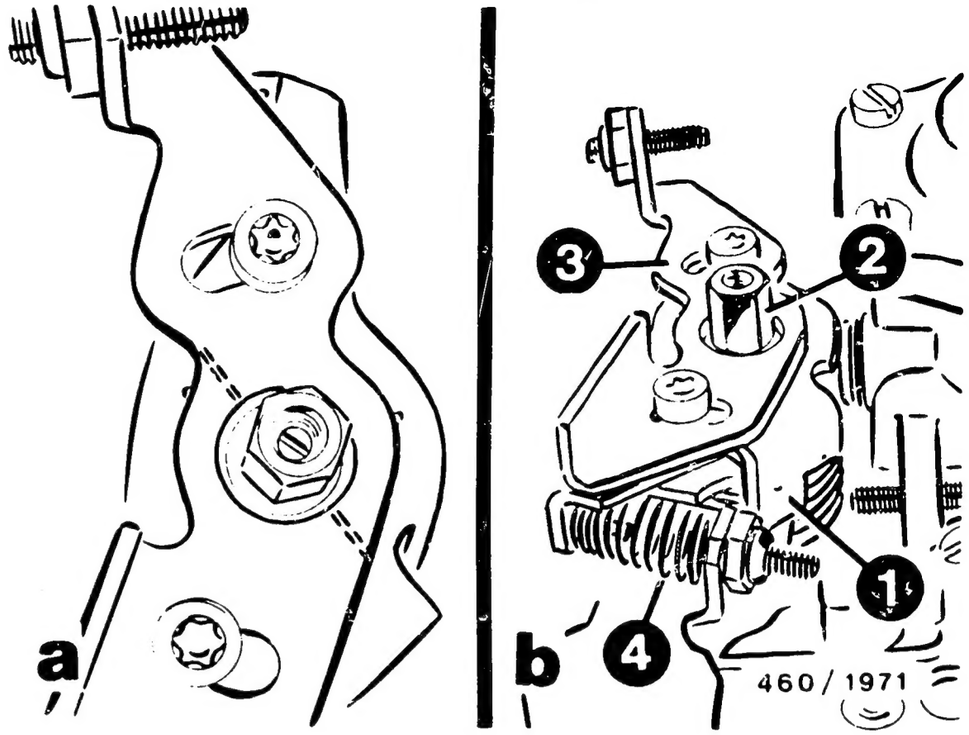
Tension cylindrical helical coiled spring.




1 = Plain washer
2 = Intermediate lever

Place plain washer on intermediate lever.



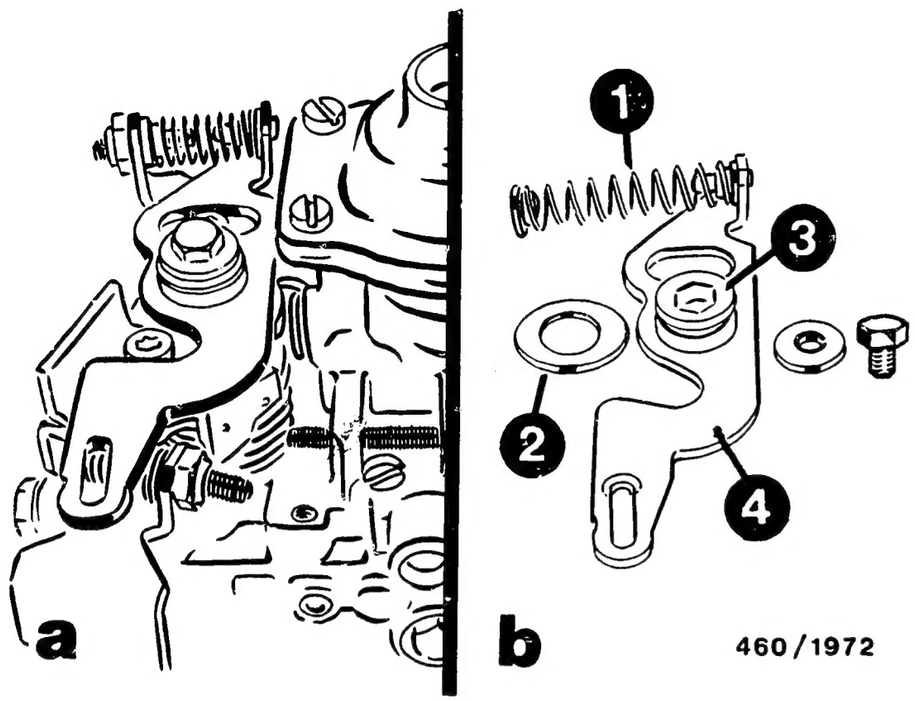



1 = Clamping lever
2 = Connecting nut
3 = Adjusting lever
4 = Damping spring

Attach clamping lever together with adjusting lever and damping spring (short version) to gear teeth of part-load regulator in such a manner that the marks on the adjusting lever and setting shaft coincide.

Screw connecting nut together with corresponding plain washer on to setting shaft.
In doing so, move control lever slightly until adjusting lever engages in gear teeth of setting shaft.

Tighten connecting nut to prescribed tightening torque 6.0...10.0 Nm.



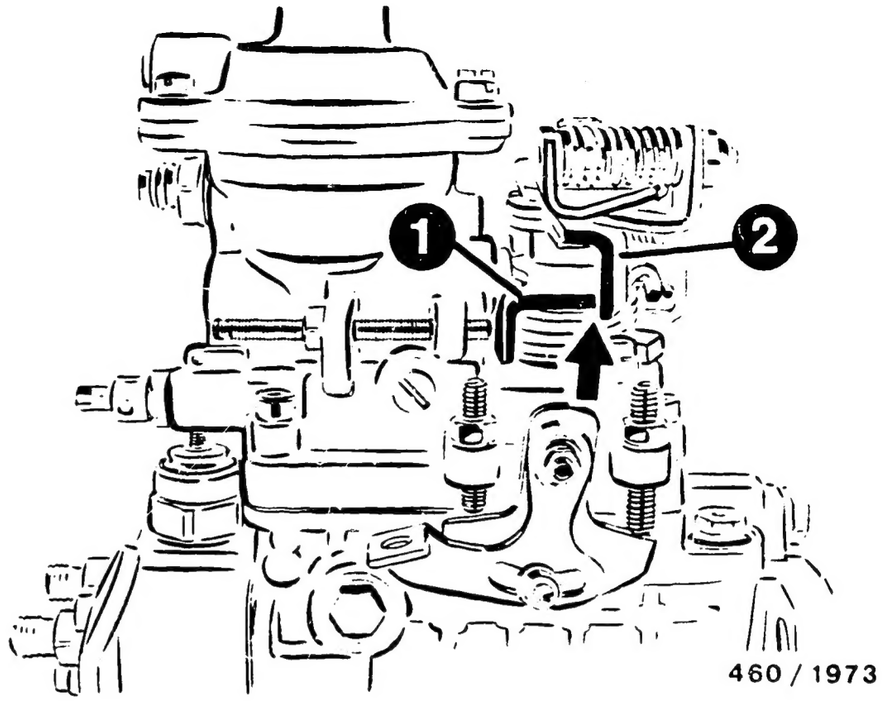

1 = Idle-motion spring
2 = Plain washer
3 = Intermediate bushing
4 = Control lever

Position plain washer on adjusting lever.
Fit intermediate bushing in control lever.
Pay attention to freedom of movement.

Slide control lever with idle-motion spring (long version) and together with intermediate bushing into connecting nut (hexagon).

Screw hexagon bolt with plain washer into connecting nut and tighten to prescribed tightening torque 2.5...4.5 Nm.






1 = Intermediate lever
2 = Clamping lever

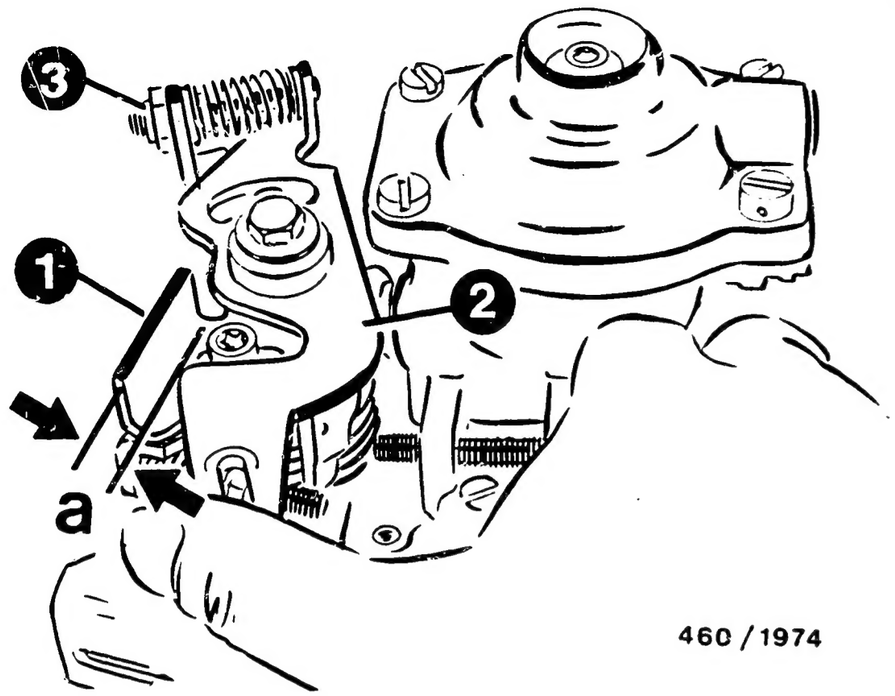
Pre-adjust damping-spring travel.

Press damping spring together.

Measure gap between intermediate lever and clamping lever (arrow).

Set value: min. 5.0 mm

Set spacing at damper adjusting screw.




1 = Adjusting lever
2 = Control lever
3 = Idle-motion adjusting screw

Adjust idle-motion-spring dimension

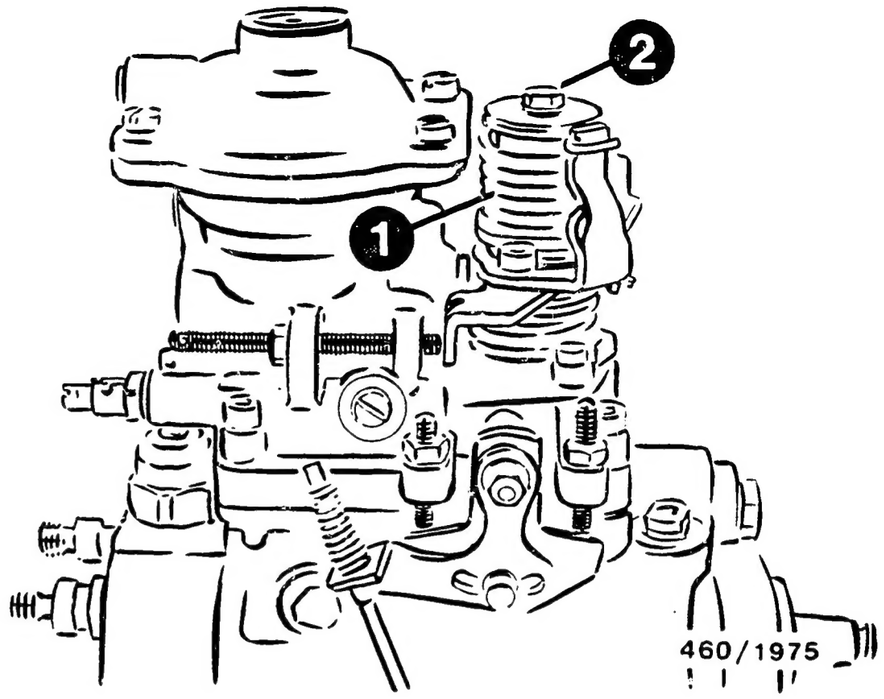
Press idle-motion spring together.

Measure dimension "a" between adjusting lever and control lever.

Set value: 3.0 mm (mark)

Correction at idle-motion adjusting screw.






1 = Upper cylindrical helical coiled spring
2 = Hexagon bolt

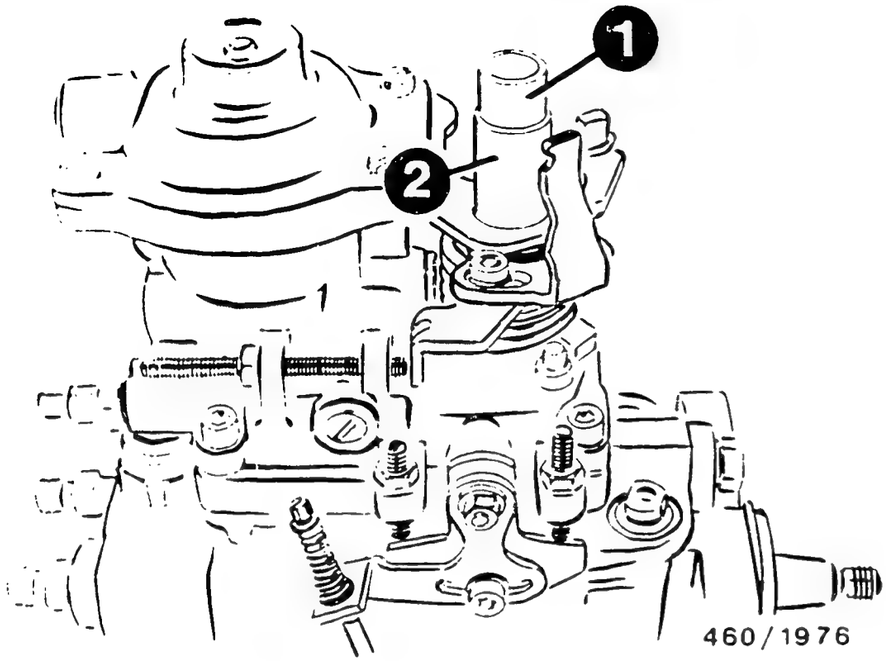
REMOVAL OF LEVER ASSEMBLY

2.Pump with spring-type load impact damping (FLD)

Disengage upper cylindrical helical coiled spring.

Remove hexagon bolt and plain washer.

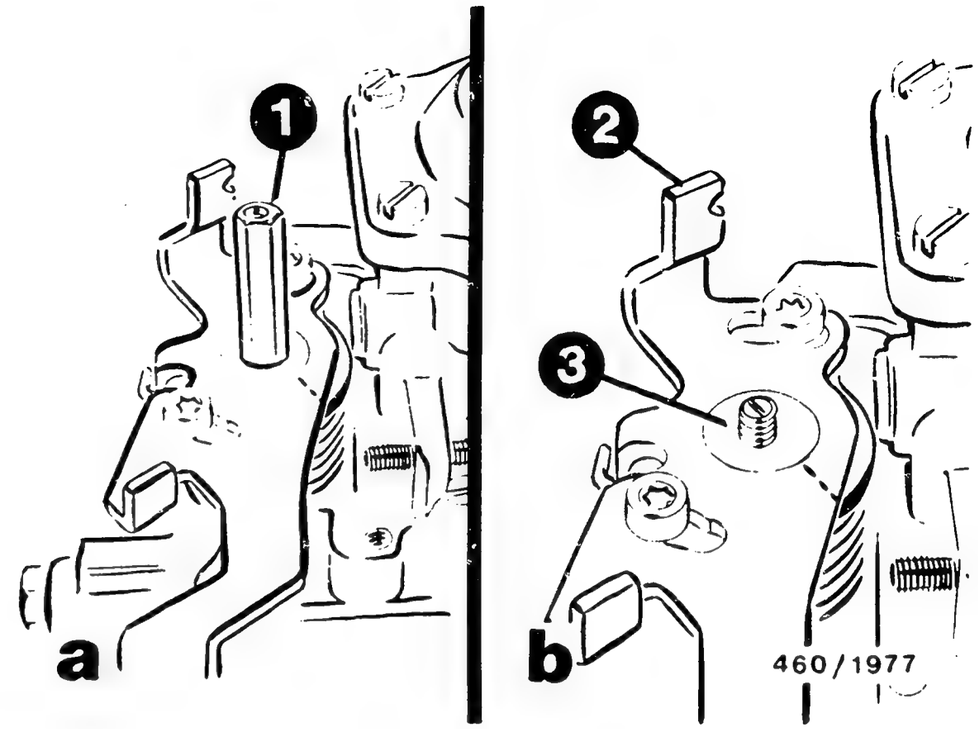
Remove cylindrical helical coiled spring and spring seat.




1 = Intermediate bushing
2 = Control lever

Pull out intermediate bushing.

Remove control lever and plain washer.




1 = Connecting nut
2 = Adjusting lever
3 = Plain washer

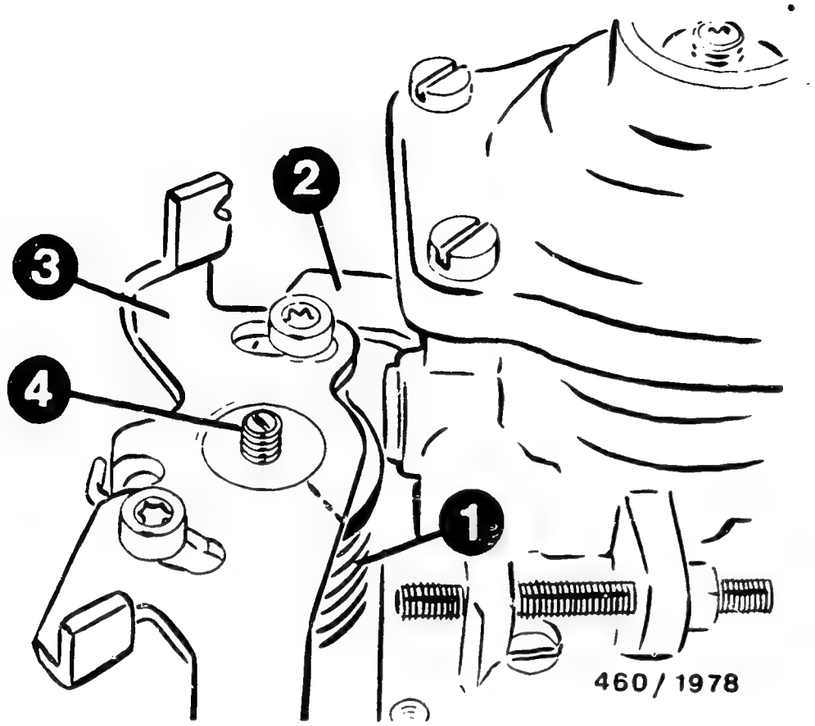
Disengage lower cylindrical helical coiled spring.

Unscrew connecting nut.

Mark adjusting lever and setting shaft with respect to one another.

Note:
Adjusting lever and setting-shaft mark beneath the plain washer (not visible in picture).

Remove adjusting lever, cylindrical helical coiled spring and spring seat.




1 = Cylindrical helical coiled spring
2 = Positioning lever
3 = Adjusting lever
4 = Setting shaft

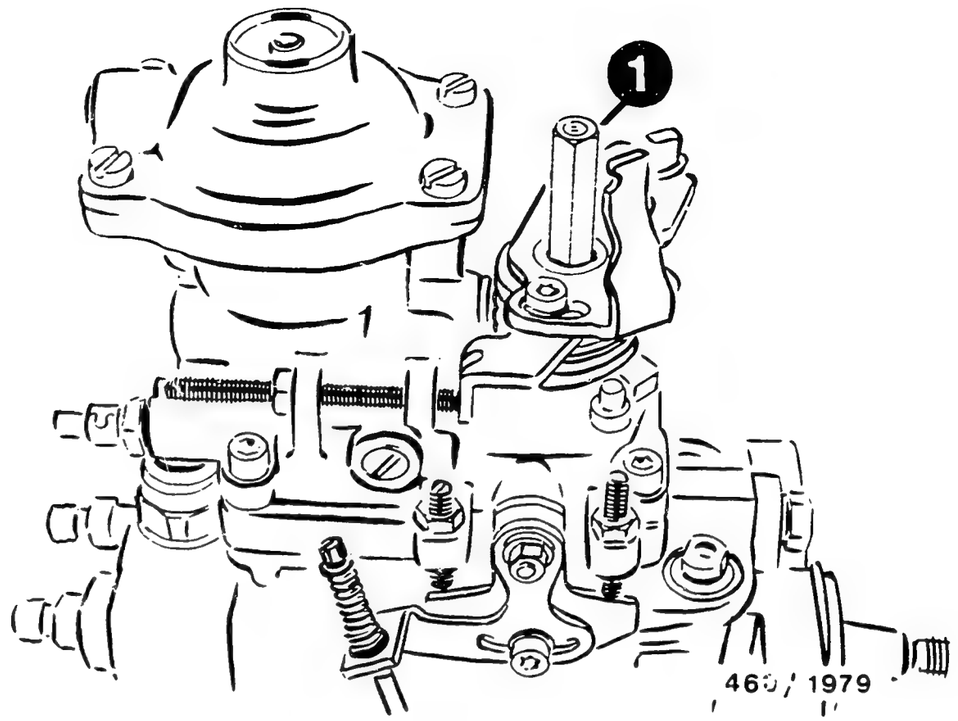
ASSEMBLING LEVER ASSEMBLY

Attach lower spring seat to setting-shaft mount.

Install cylindrical helical coiled spring (large diameter) with upper spring seat.

Attach positioning lever and adjusting lever to setting shaft such that mark on positioning lever coincides with mark on setting shaft.

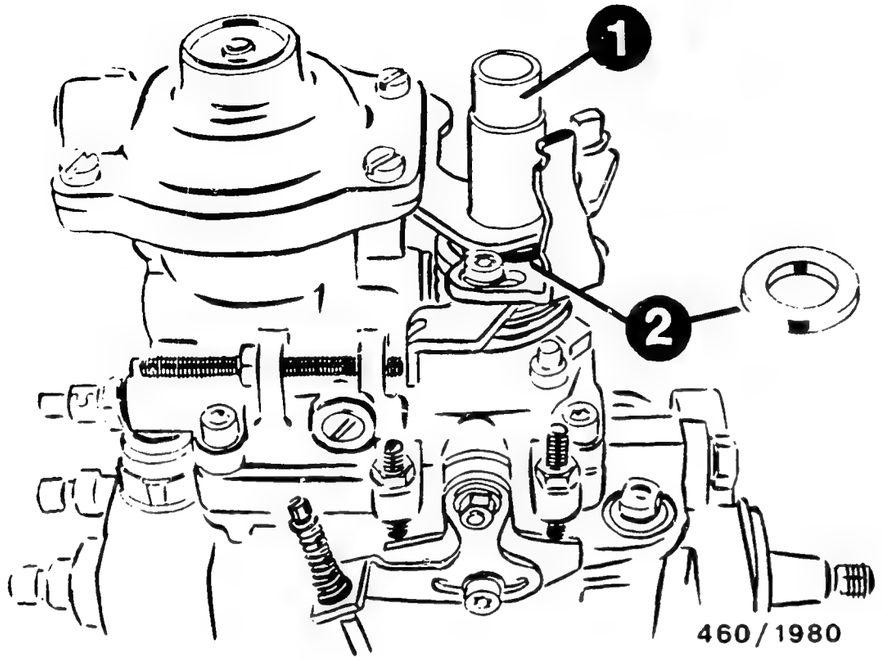





1 = Connecting nut

Screw connecting nut on to setting shaft and tighten to prescribed tightening torque 6.0...10.0 Nm. Always comply with tightening torque.

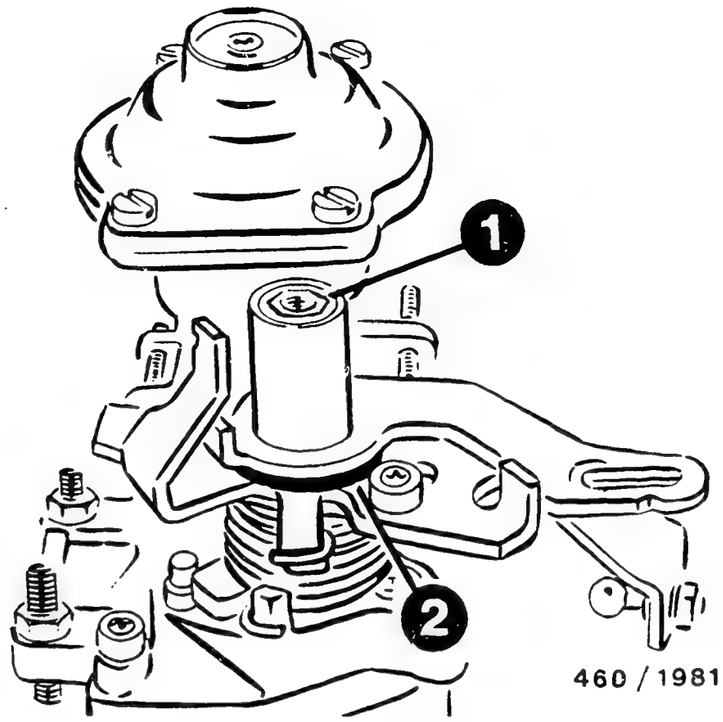
Place lower cylindrical helical coiled spring in position.




1 = Intermediate bushing
2 = Plain washer

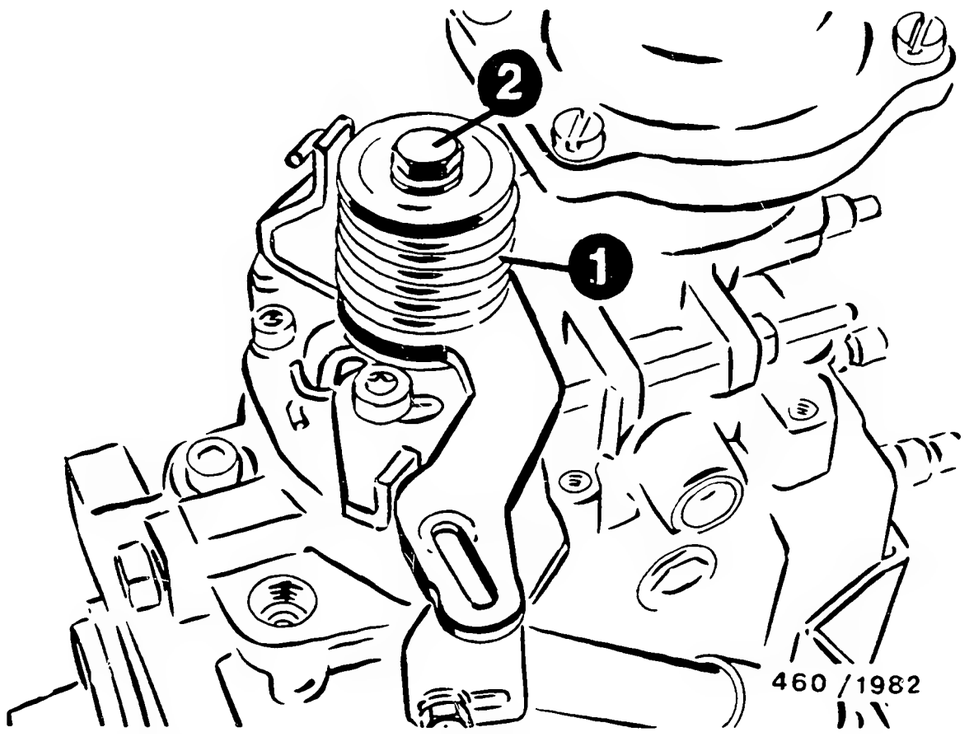
Attach plain washer to adjusting lever.

Attach control lever without intermediate bushing.




1 = Intermediate bushing
2 = Plain washer

Fit intermediate bushing in control lever. Ensure that intermediate bushing and plain washer lie flat at adjusting lever.




1 = Cylindrical helical coiled spring
2 = Hexagon bolt

Attach cylindrical helical coiled spring (small diameter) to control lever.

Screw on hexagon nut with plain washer and tighten to prescribed tightening torque 2.5...4.5 Nm.
Always comply with tightening torque.

Place cylindrical helical coiled spring in position.

For production reasons:
continued on the following coordinate.

Instructions : W-460/305

BOSCH system : Mechanical load impact damping (MLD) and spring-type load impact damping (FLD)

for distributor-type fuel-injection pump (VE)

Basic microcard : W-400/012

TABLE OF CONTENTS





SPECIAL FEATURES

This microcard deals with the testing and adjustment of distributor-type fuel-injection pumps with:
-Mechanical load impact damping (MLD)
-Spring-type load impact damping (FLD)
It is based on the detailed test instructions W-400/012.

Distributor-type fuel-injection pumps feature the following add-on modules:
-Idle spring permanently connected to housing (LFG)
-Idle-speed increase, coupled with timing device acting on cold-start accelerator (KSB).
-Mechanical load impact damping (MLD) or
-Spring-type load impact damping (FLD)

TEST SPECIFICATIONS

for residual quantity,
spacer dimension a = 2.0 mm

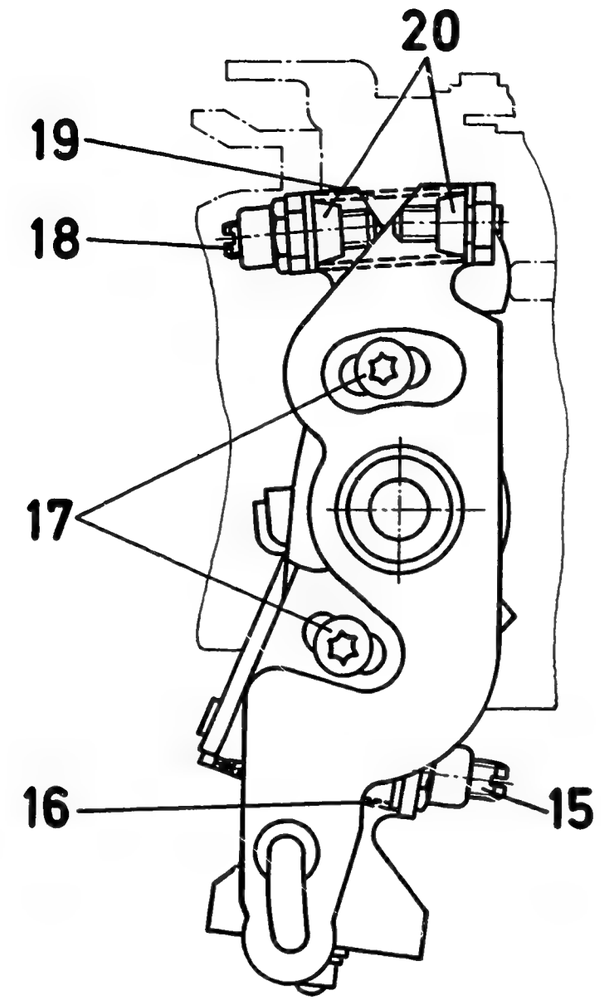
Adjusting-screw pre-adjustment following pump repair:

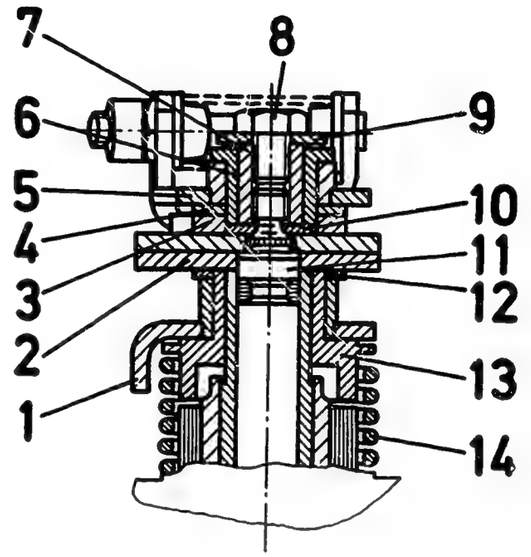
| | |
|---|---|
| Rated-speed adjusting screw | 8.0...9.0 mm |
| Idle-speed adjusting screw | 6.5...7.5 mm |
| Residual-quantity stop screw | 6.0 mm |
| Stop screw for high idle | 10.0...11.0 mm |

Assignment of LFG-stop lever to timing device-KSB
Connecting rod dimension a: 90.5 ± 0.5 mm

Ball-pin spacing for hydraulic damper:

| | |
|---|---|
| Mechanical load impact damping: | 167.0 ± 1.0 mm |
| Spring-type load impact damping: | 174.0 ± 1.0 mm |

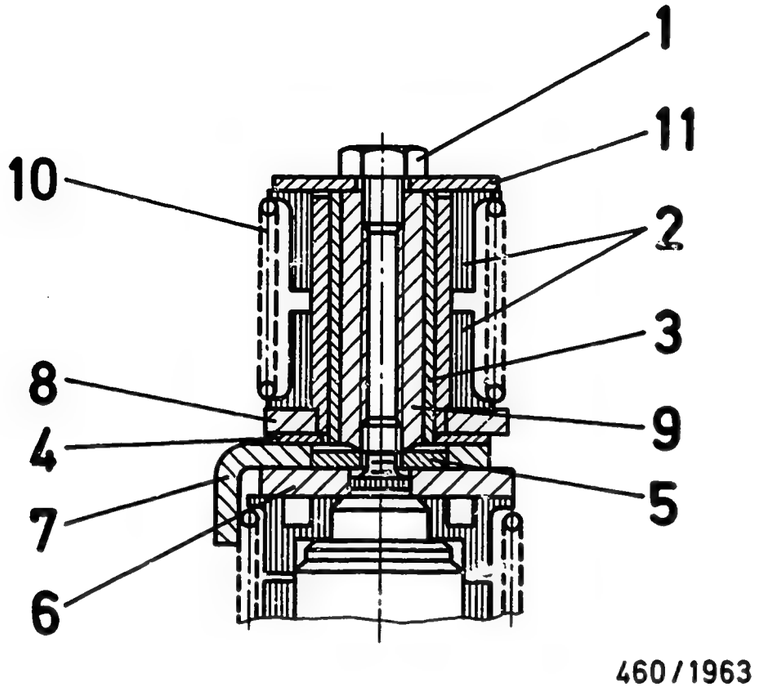



460/1962

1 = Intermediate lever
2 = Clamping lever
3 = Adjusting lever
4 = Plain washer
5 = Control lever
6 = Intermediate bushing
7 = Connecting nut
8 = Hexagon nut
9 = Plain washer
10 = Shim
11 = Part-load regulator
12 = Plain washer
13 = Spring seat
14 = Cylindrical helical coiled spring
15 = Headless set screw
16 = Compression spring
17 = Torx bolt
18 = Headless set screw
19 = Compression spring
20 = Spring seat

INDIVIDUAL COMPONENTS OF MECHANICAL LOAD IMPACT DAMPING (MLD)

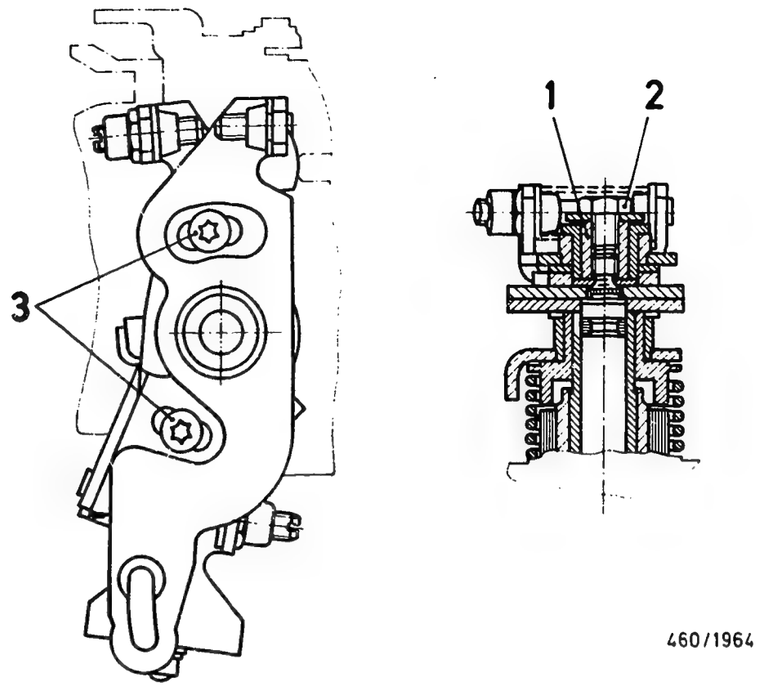



460/1963

1 = Hexagon bolt
2 = Spring seat
3 = Intermediate bushing
4 = Plain washer
5 = Plain washer
6 = Positioning lever
7 = Adjusting lever
8 = Control lever
9 = Connecting nut
10 = Cylindrical helical coiled spring
11 = Plain washer

INDIVIDUAL COMPONENTS OF SPRING-TYPE LOAD IMPACT DAMPING (FLD)






460/1964

| | |
|---|---|
| 1 = Connecting nut | 6.0...10.0 Nm |
| 2 = Hexagon bolt | 2.5... 4.5 Nm |
| 3 = Torx fillister-head screw | 10.0...14.0 Nm |

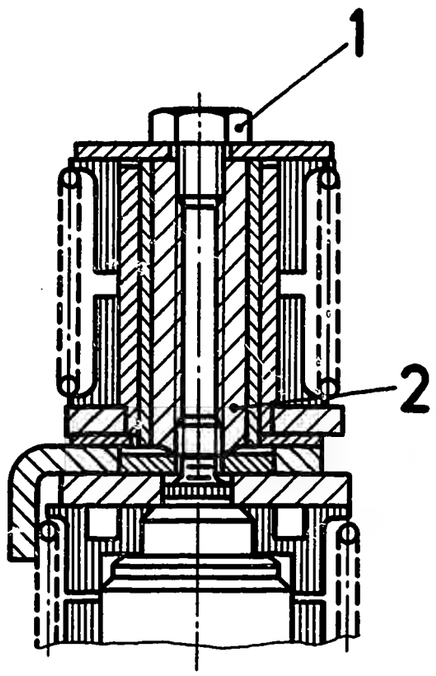
TIGHTENING TORQUES

-Pump with mechanical load impact damping

N O T E :

Tightening torques must be complied with.
If the hexagon bolt is tightened more than the connecting nut, the entire lever assembly will be loosened on subsequent disassembly (due to loosening of the connecting nut).
The pre-tensioned compression springs between the levers may spring away in an uncontrolled manner.

| | |
|---|---|
| Fastening screw, KSB-basic lever | 8..12 Nm |
| Fastening screw at LFG-stop lever | 2...3 Nm |




460/1965

1 = Connecting nut 6.0...10.0 Nm
2 = Hexagon bolt 2.5... 4.5 Nm
3 = Torx fillister-head screw 10.0...14.0 Nm
(see MLD )

-Pump with spring-type load impact damping

N o t e :
Always comply with tightening torques.

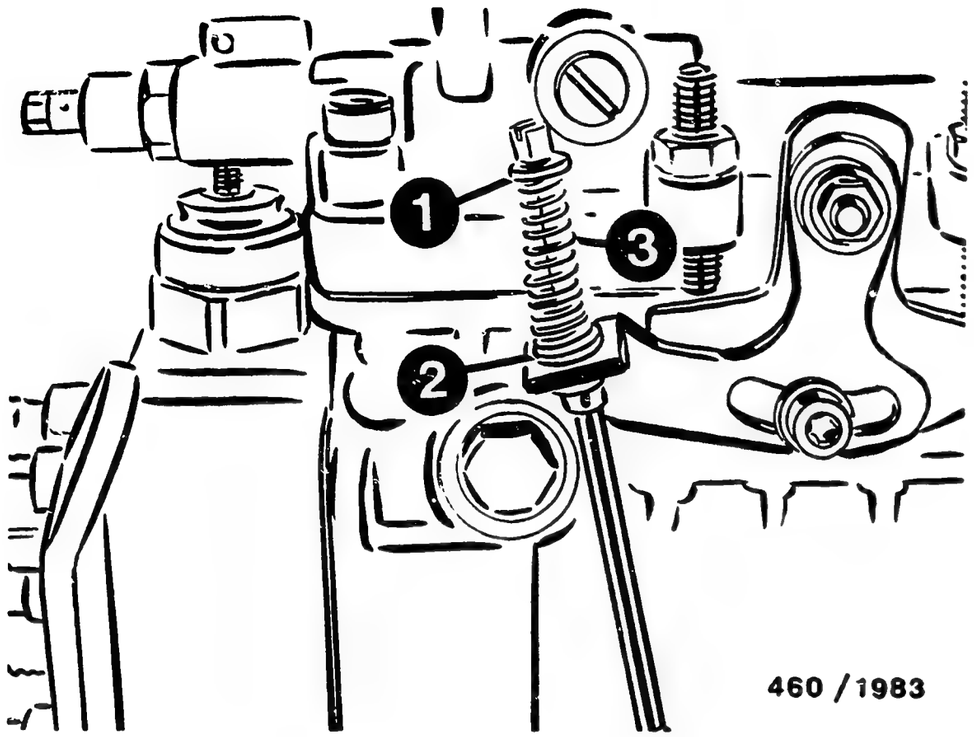
If the hexagon bolt is tightened more than the connecting nut, the entire lever assembly will be loosened on subsequent disassembly (due to loosening of connecting nut).
The pre-tensioned compression springs between the levers may spring away in an uncontrolled manner.

Fastening screw KSB-
basic lever 8...12 Nm

Fastening screw at LFG-
stop lever 2...3 Nm

TESTERS AND TOOLS

| | |
|---|---|
| Timing-device measuring tool | 1 688 130 139 |
| Feeler gauge | Commercially available |
| Fluid-level gauge | KDEP 1158 |
| Torque wrench | 0...20 Nm |
| Injection-pump test bench | |




1 = Guide sleeve
2 = Support ring
3 = Compression spring

TEST SEQUENCE

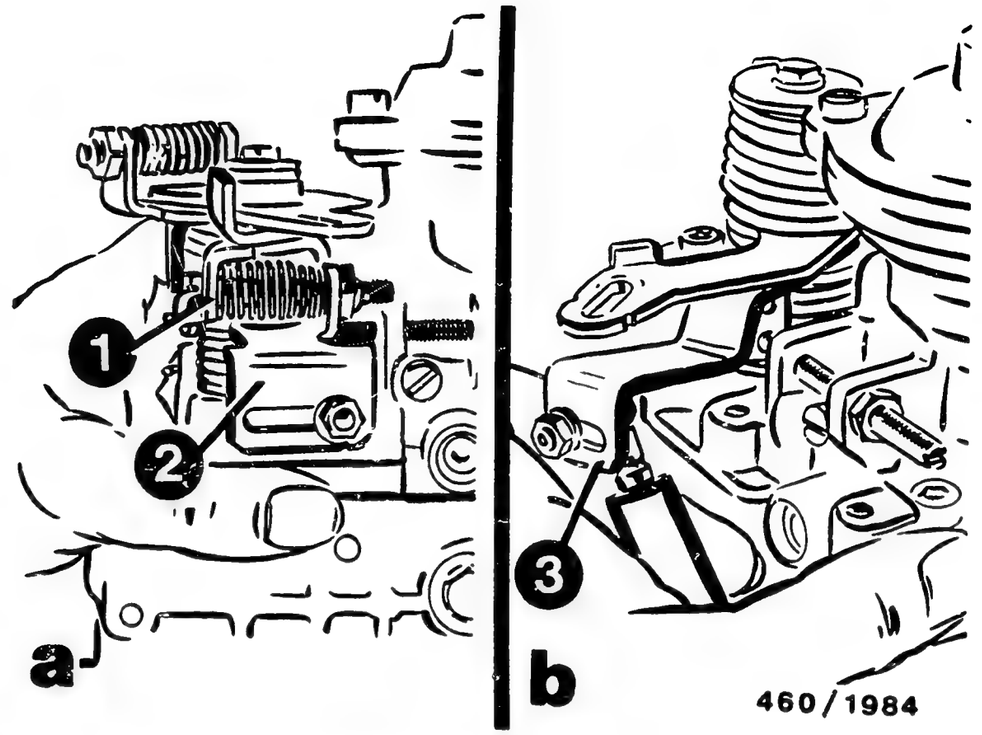
Remove hydraulic damper (fitted on side).

Remove guide rod:
Press compression spring against support ring.
Remove guide sleeve.
Remove compression spring with support ring.

Unscrew timing-device KSB-cover and remove together with guide rod.

Attach timing-device measuring tool.

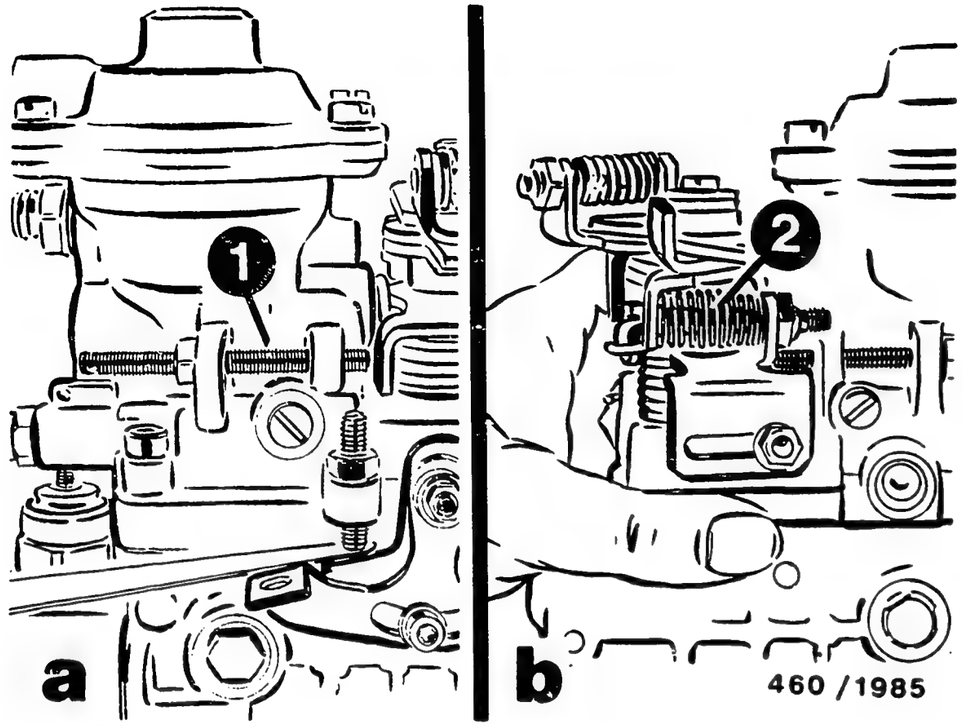





1 = Clamping lever (MLD)
2 = Intermediate lever (MLD)
3 = Adjusting lever (FLD)

ADJUSTING FULL LOAD AND SPEED REGULATION:
Set control-lever position Yb.
Attach fluid-level gauge KDEP 1158 to clamping flange and measure dimension "Yb" (distance between fluid-level gauge and control lever).
Set value : test-specification sheet

Move intermediate lever (MLD) or adjusting lever (FLD) to rated-speed stop.
N o t e :
On pumps with MLD, the compression spring (damping spring) between clamping lever and intermediate lever is over-compressed in this lever position.
Picture a = pump with MLD
Picture b = pump with FLD
Measure deliveries in accordance with test-specification sheet and adjust if necessary.
Dimension "Ya" is not set until testing has been completed.




1 = Residual-quantity stop screw
2 = Compression spring (damping spring)

TEST RESIDUAL QUANTITY

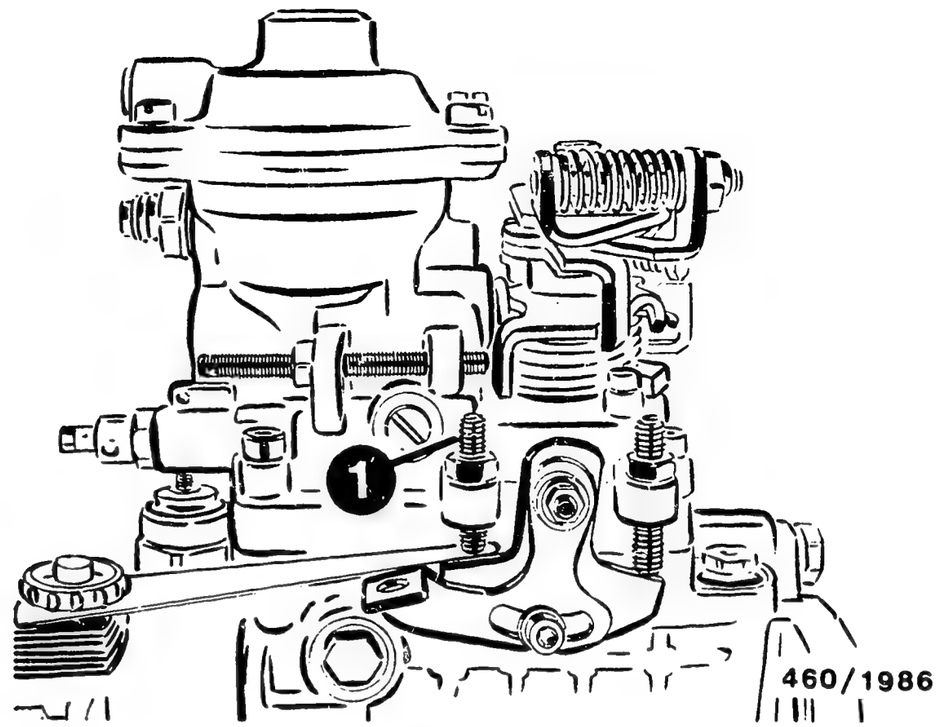
Depending on pump version, move intermediate lever or adjusting lever to residual-quantity stop screw.

Note for pump with MLD
Do not over-compress compression spring (damping spring) in this lever position.

Fit 2 mm spacer (e.g. feeler gauge) between LFG-stop lever and idle stop screw.

Run up to speed indicated in test-specification sheet and measure delivery.
Delivery can be adjusted by way of residual-quantity stop screw.






1 = Idle stop screw

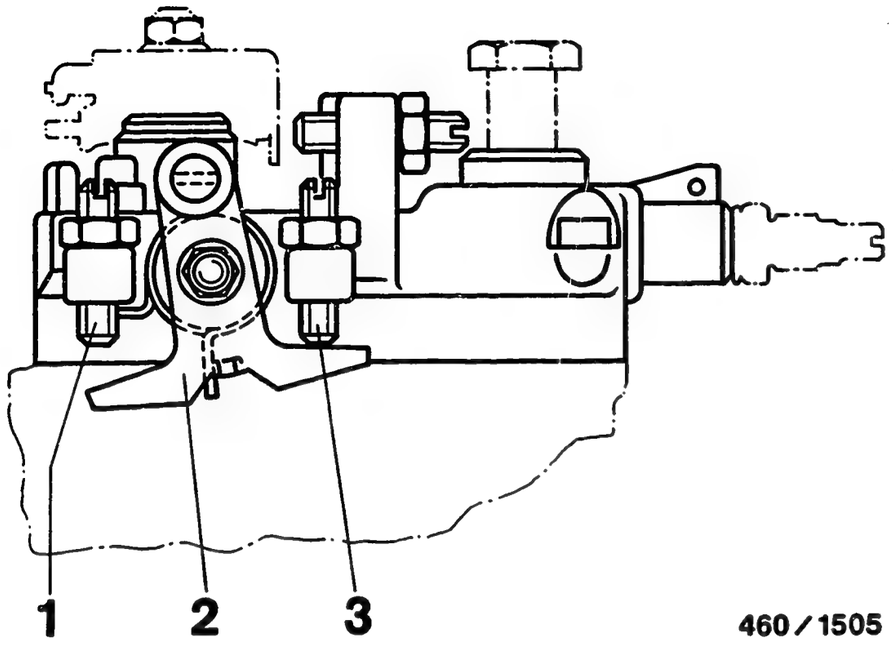
TEST IDLE-SPEED ADJUSTMENT

Move LFG-stop lever with spacer 2 mm to idle stop screw.

Run up to speed and measure delivery.

Adjust delivery by means of idle stop screw.

Speed control lever is on residual-quantity stop.




460/1505

1 = Idle stop screw
2 = LFG–stop lever
3 = Stop screw for high idle

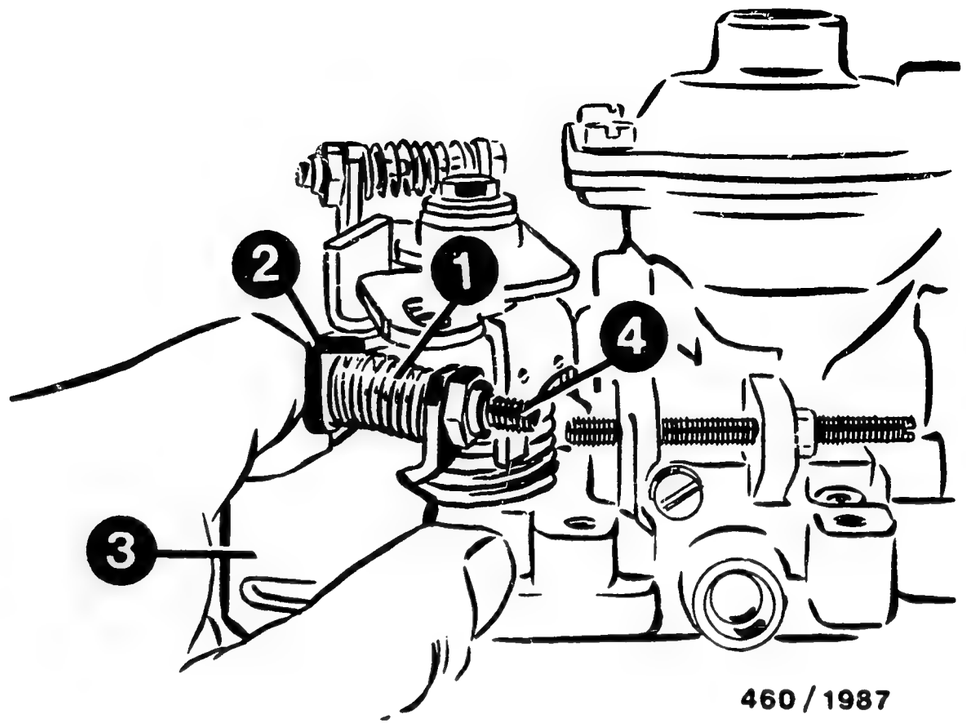
TEST HIGH IDLE

Position LFG–stop lever on high idle stop.

Run up to high idle speed and measure delivery.

Adjust delivery by way of adjusting screw.






460/1987

1 = Compression spring (damping spring)
2 = Clamping lever
3 = Intermediate lever
4 = Adjusting screw

TEST DAMPER RATE

–Pump with MLD

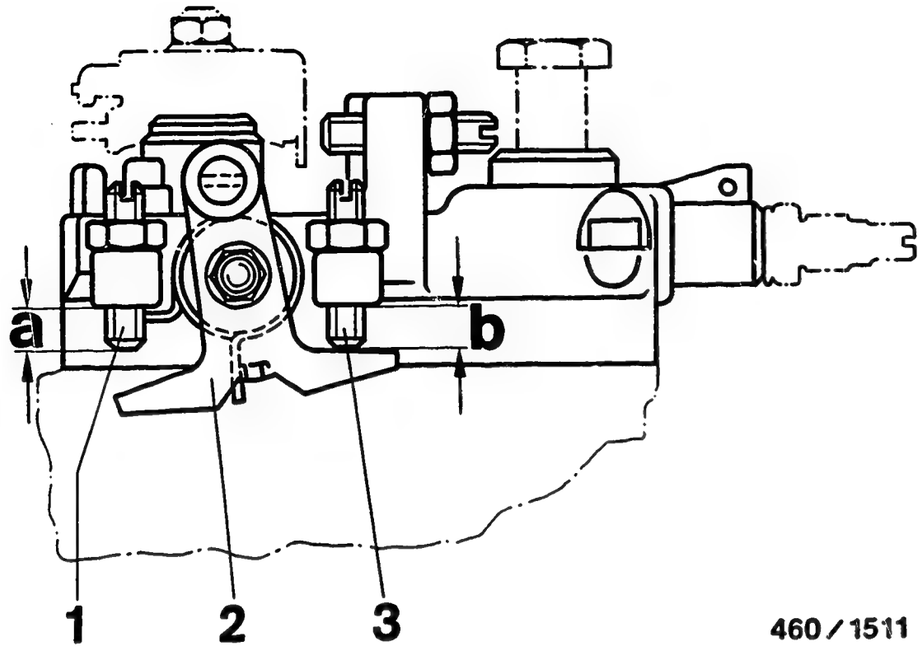
Over–compress damping spring between clamping lever and intermediate lever.

Intermediate lever makes contact with residual–quantity stop screw.

Adjust damper rate by way of adjusting screw.

Clockwise direction = less

Counter–clockwise direction = more




460/1511

1 = Idle-speed adjusting screw
Dimension a = 6.5...7.5 mm
2 = LFG-stop lever
3 = Stop screw for high idle
Dimension b = 10.0...11.0 mm

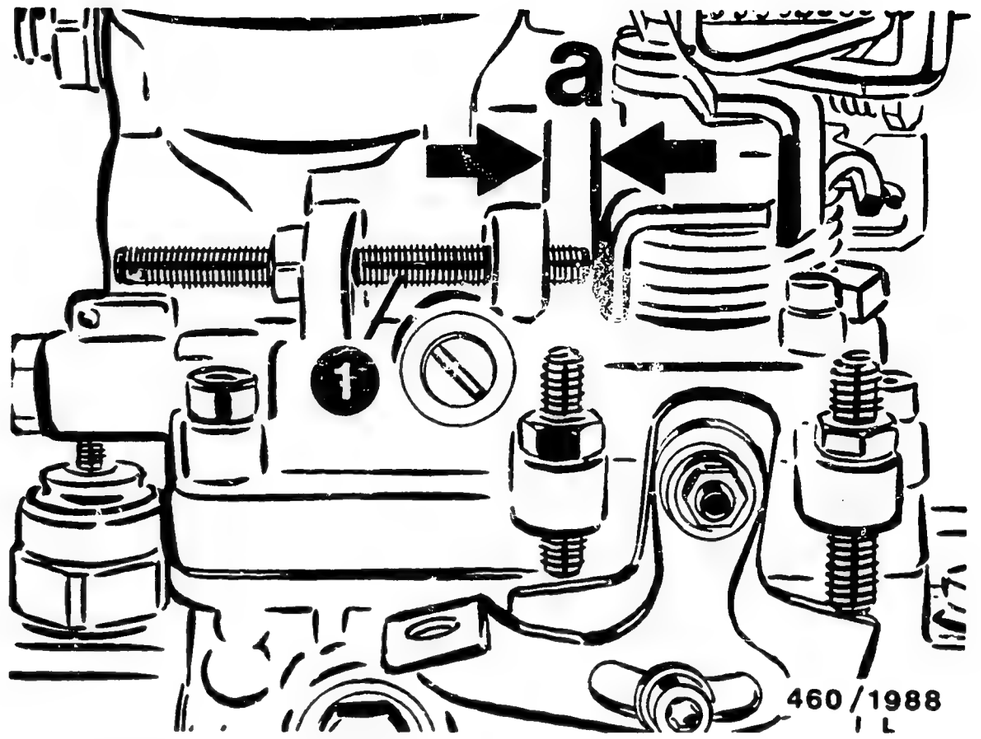
ADJUSTMENT SEQUENCE FOLLOWING PUMP REPAIR

Guide rod and timing-device KSB-cover not yet fitted.

Adjust fuel-injection pump to idle setting in accordance with test instructions.

Pre-adjust idle-speed adjusting screw 1 and 3.






460/1988

1 = Residual-quantity stop screw
Dimension a = 6.0 mm

Adjust residual quantity

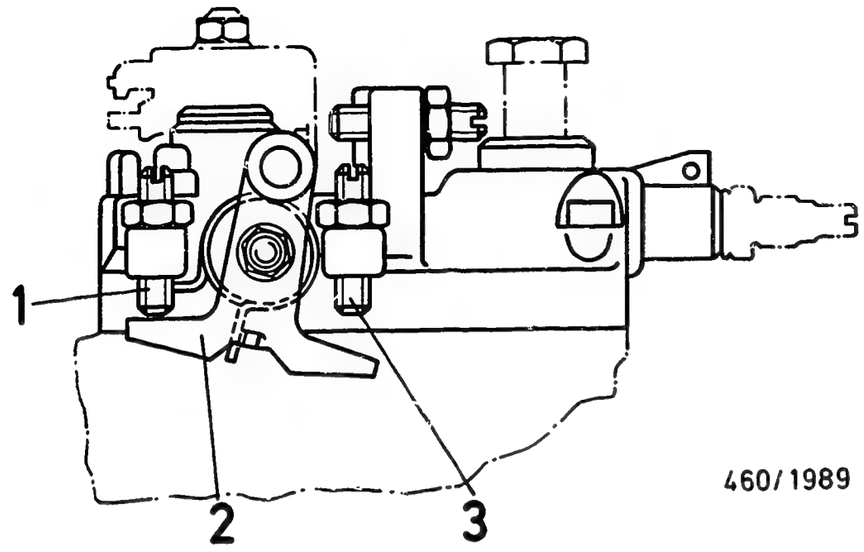
Run up to speed indicated in test-specification sheet.

Move intermediate lever to residual-quantity stop screw.

LFG-stop lever makes contact with idle-speed adjusting screw.

Measure delivery.

Adjust delivery to mid-tolerance range by way of adjusting screw.




1 = Idle-speed adjusting screw
2 = LFG-stop lever
3 = Stop screw for high idle

Adjust idle speed

Move LFG-stop lever to idle-speed adjusting screw.

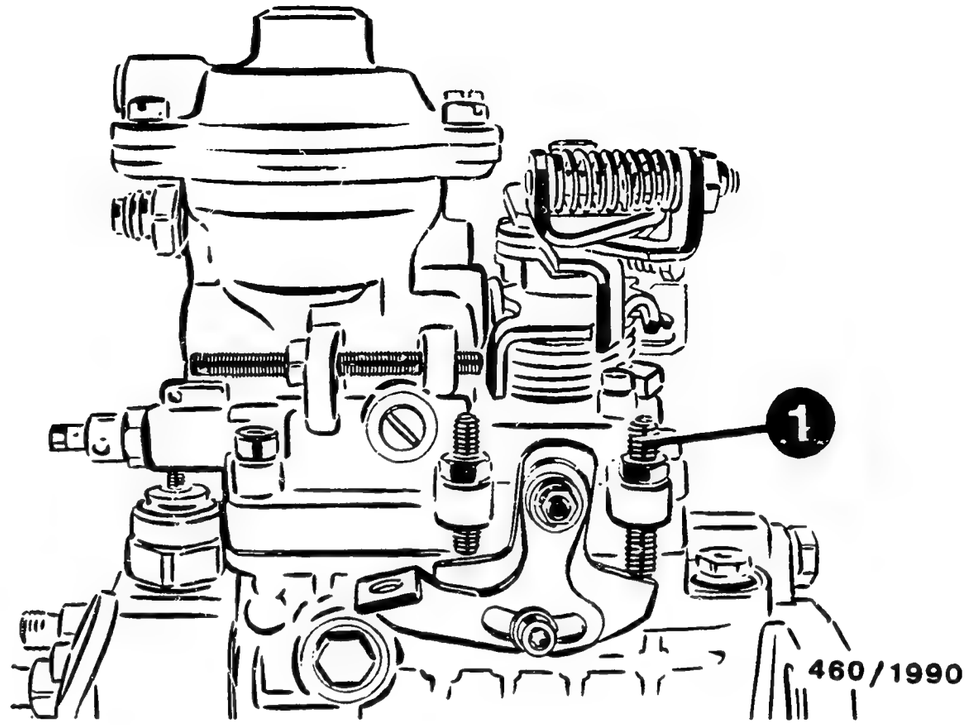
Intermediate lever makes contact with residual-quantity stop screw.

Run up to speed.

Measure delivery.

Adjust delivery to mid-tolerance range by way of idle-speed stop screw.






1 = Stop screw for high idle

Adjust high idle

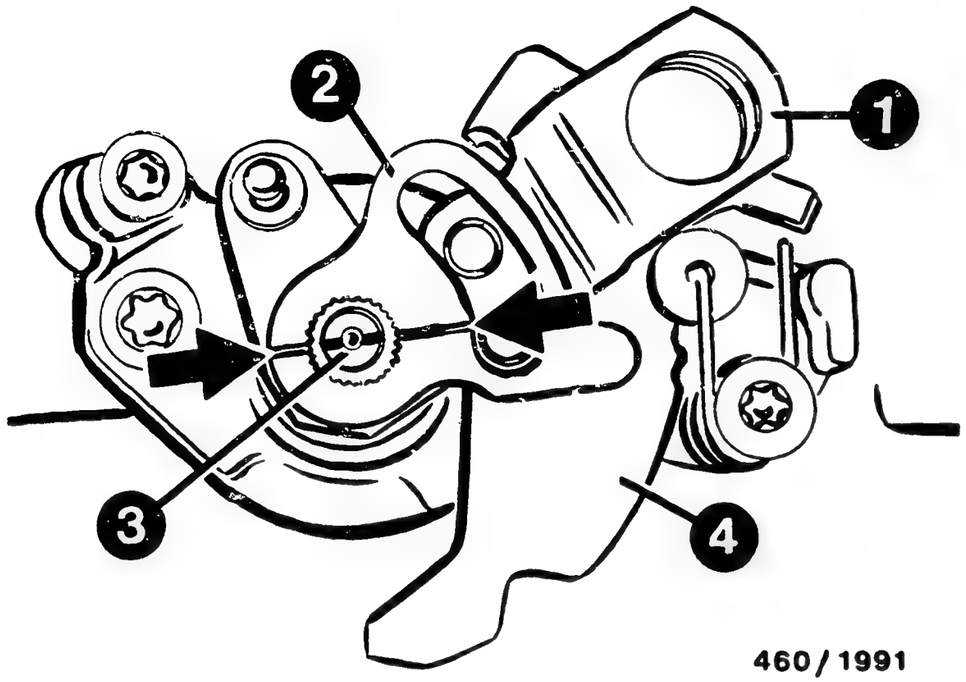
Move LFG-stop lever to high idle stop.

Run up to speed and measure delivery.

Adjust delivery to mid-tolerance range by way of adjusting screw.

After adjusting idle, check and if necessary alter residual quantity.

Remove timing-device measuring tool.




460/1991

1 = KSB – control lever
2 = Basic lever
3 = Lever shaft
4 = Bell crank

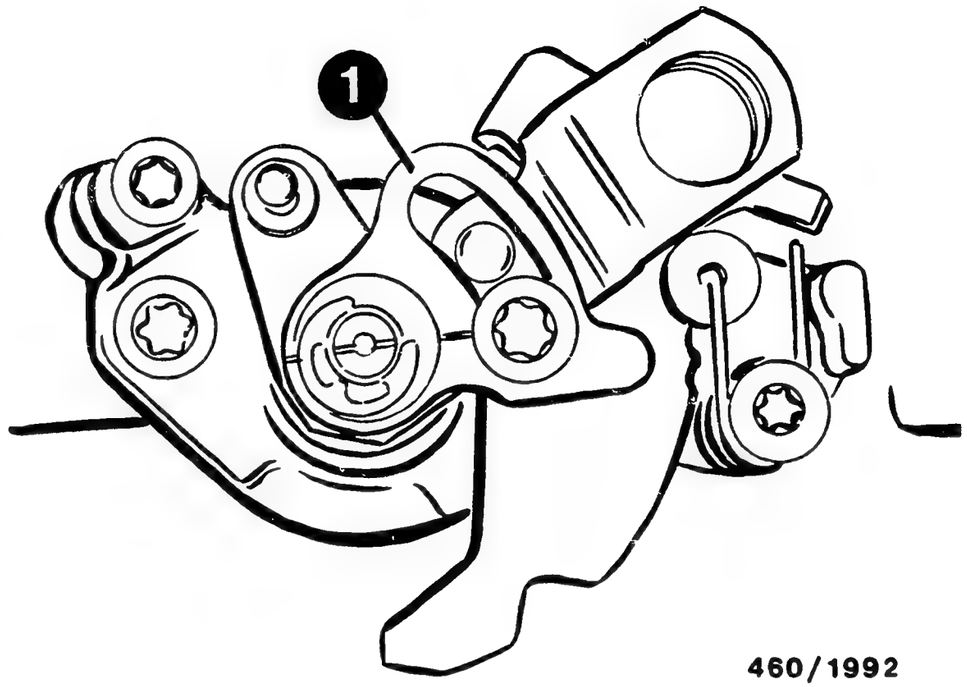
ASSEMBLY OF TIMING-DEVICE KSB-COVER

Attach KSB control lever to lever shaft and move bell crank to housing stop (housing stop cannot be seen in picture).

Position basic lever with mark on lever-shaft gear teeth such that the two marks coincide (arrows).

Turn basic lever until tapped hole is at end of slot.
Screw in fillister-head screw (do not tighten).
Attach spring washer and plain washer to lever shaft.
Press down plain washer and fit locking washer.






460/1992

1 = Basic lever

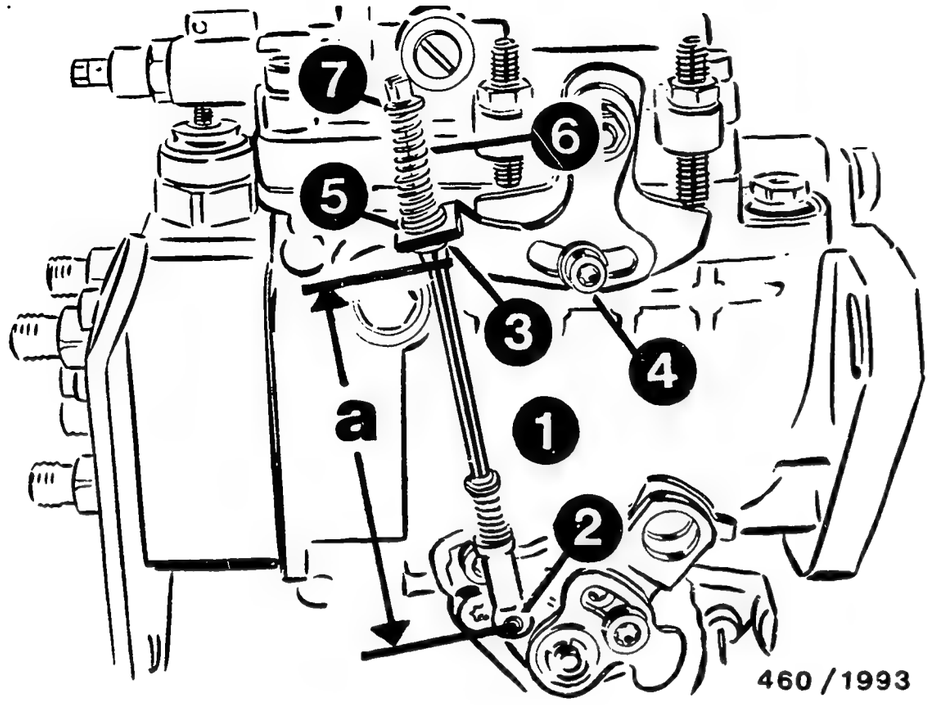
DETERMINATION OF KSB – STROKE COMMENCEMENT

Affix KSB control lever in 2nd detent position.

Turn basic lever until pressure point (stroke commencement) is reached.

Affix basic lever in this position.

Tighten fastening screw to 8...12 Nm.



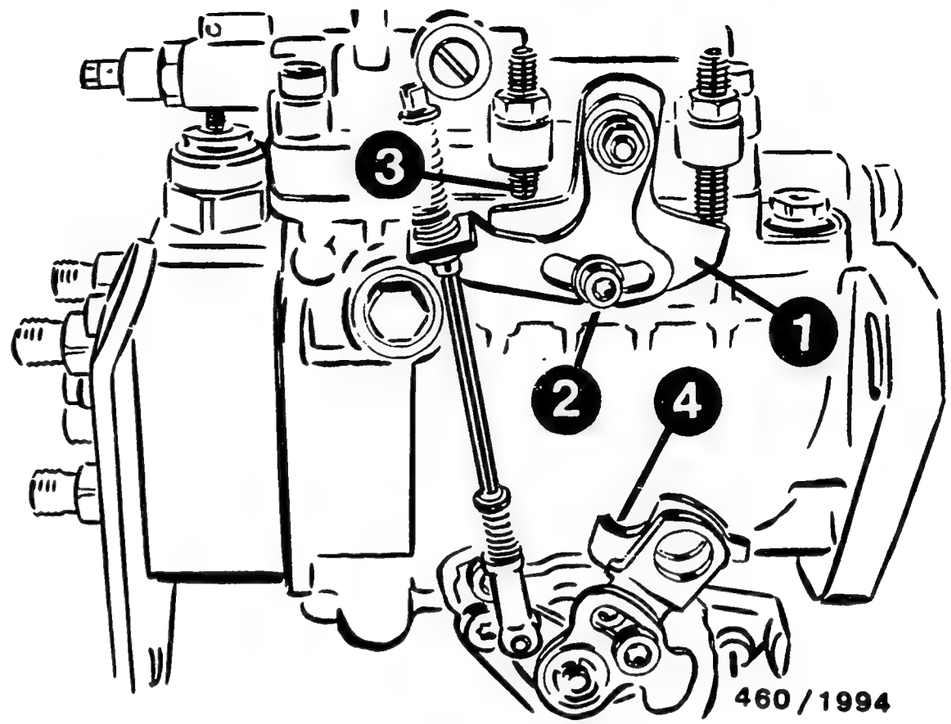

1 = Guide rod
2 = Locking washer
3 = Stop ring
4 = Fastening screw, LFG-lever
5 = Support ring
6 = Compression spring
7 = Guide sleeve

TESTING AND ADJUSTMENT OF ASSIGNMENT OF LFG-STOP LEVER TO TIMING-DEVICE - KSB

Set guide rod to dimension a = 90.5 ± 0.5 mm
Loosen fastening screw at LFG-stop lever.
Push stop ring on to guide rod and insert through hole in LFG-stop lever.

Fit guide rod with locking washer on to KSB-control lever.
Attach support ring and compression spring to guide rod and assemble guide sleeve.





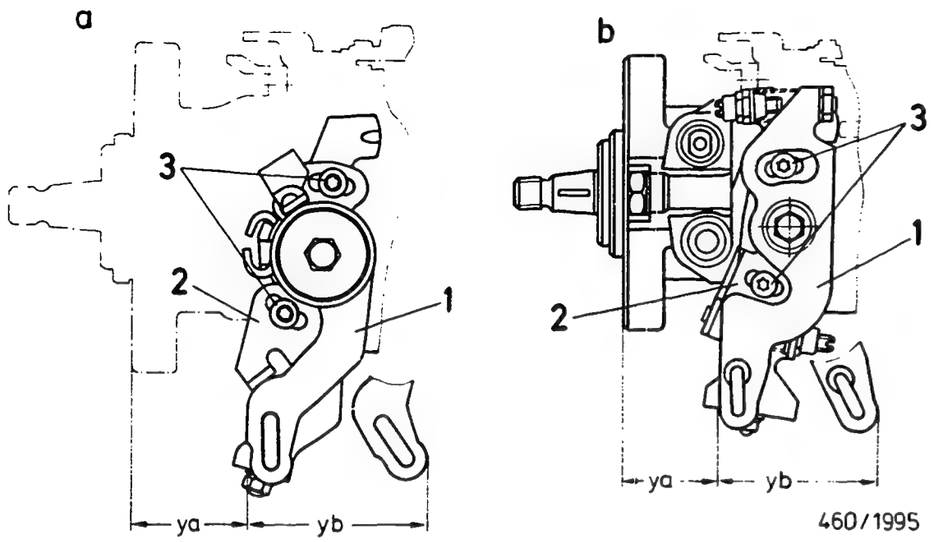

1 = LFG-stop lever
2 = Fastening screw, LFG-stop lever
3 = Idle-speed adjusting screw
4 = Bell crank

Move KSB-control lever to housing stop (housing stop is located behind bell crank).

Move LFG-stop lever to idle-speed adjusting screw.

Tighten fastening screw at LFG-stop lever in this position to 2...3 Nm.

Unscrew idle-speed adjusting screw by 2 turns (corresponds to 2 mm).




1 = Control lever
2 = Adjusting lever
3 = Fastening screws

TESTING AND ADJUSTMENT OF CONTROL-LEVER POSITION "Ya"

Attach fluid-lever gauge KDEP 1158 to clamping flange and measure dimension "Ya" (distance between fluid-level gauge and control lever).

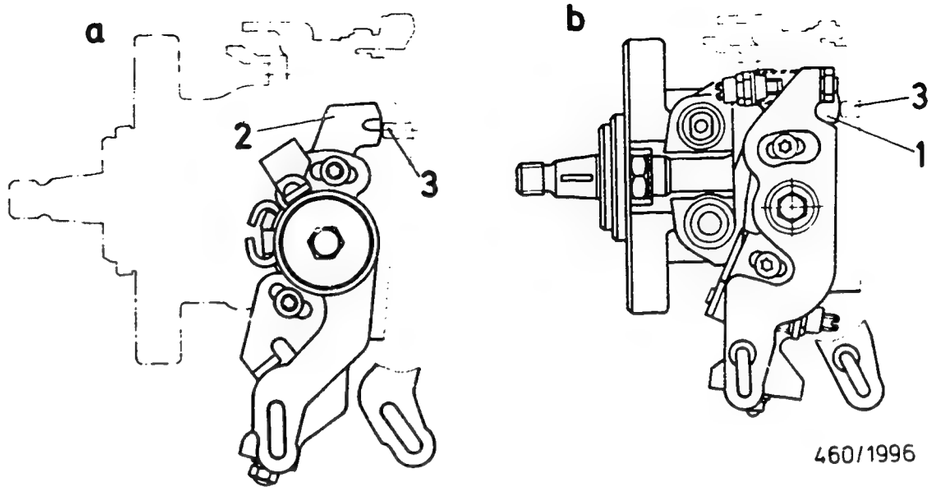
Refer to test-specification sheet for set value.

Loosen fastening screws if set value is not attained.

Turn adjusting lever in area of slots and adjust set value in accordance with test-specification sheet.
Picture a = pump with FLD
Picture b = pump with MLD

Tighten fastening screws to prescribed tightening torque 10.0...14.0 Nm.






1 = Intermediate lever (MLD)
2 = Positioning lever (FLD)
3 = Residual-quantity stop screw

TESTING AND ADJUSTMENT OF BALL-PIN SPACING FOR HYDRAULIC DAMPER

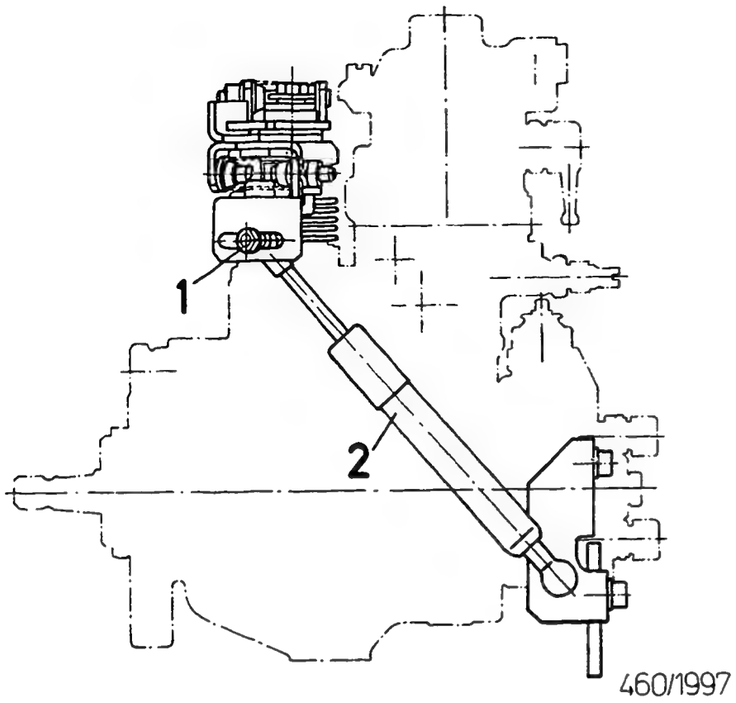
Prerequisite:
Intermediate lever (pump with MLD) or positioning lever (pump with FLD) is in contact with residual-quantity stop screw.

Measure distance between center of ball pin at intermediate lever and center of ball pin at mounting bracket.

Set value:

-Mechanical load impact damping : 167 ±1.0 mm
-Spring-type load impact damping: 174 ±1.0 mm

Picture a = pump with FLD
Picture b = pump with MLD




1 = Ball pin
2 = Hydraulic damper

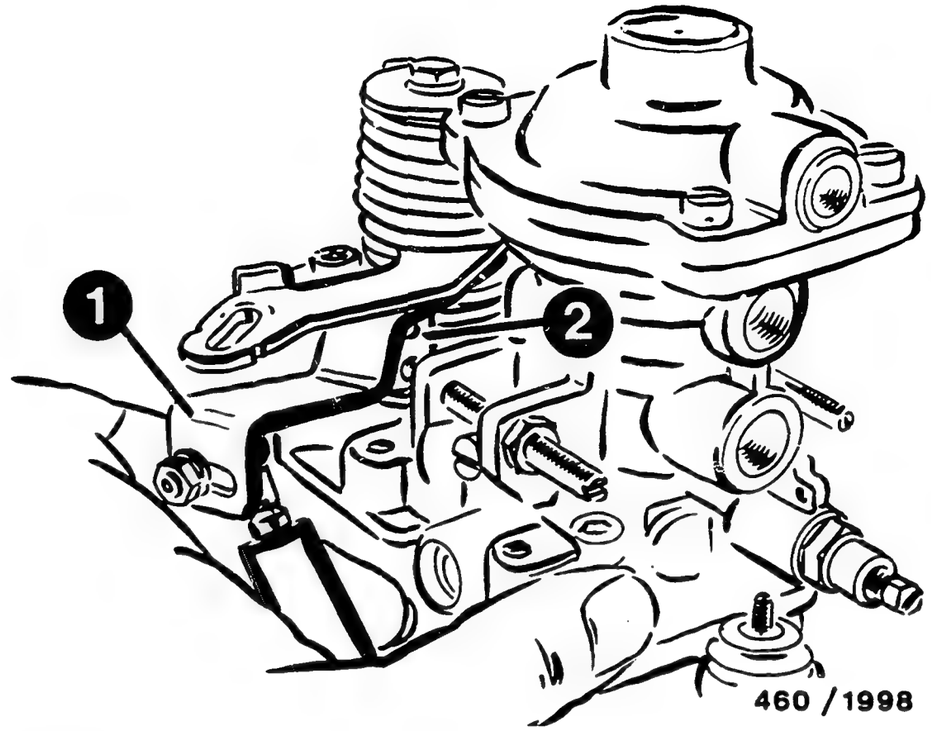
Adjust ball pin in slot area if necessary.

Correctly position hydraulic damper.

Position hydraulic damper between ball pin at intermediate lever/adjusting lever and at mounting bracket.

Residual-quantity adjustment must not be influenced.






1 = Adjusting lever
2 = Positioning lever

Functional test (FLD)

Prerequisite:

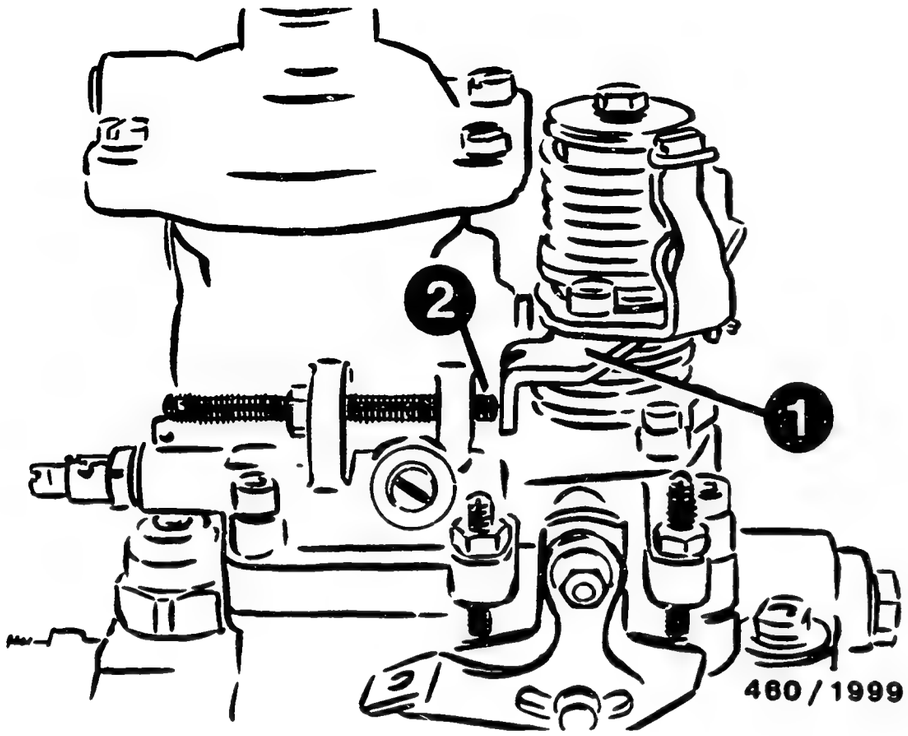
- Pump adjusted and assembled.

- Ball-pin spacing for hydraulic damper set.

Position hydraulic damper in ball pin.

Move adjusting lever including hydraulic damper until positioning lever makes contact with rated-speed adjusting screw.

Fix control lever in this position.




1 = Positioning lever
2 = Residual-quantity stop screw

Pull back adjusting lever together with hydraulic damper until positioning lever makes contact with residual-quantity stop screw.

Release adjusting lever.

The excess force of the cylindrical helical coiled spring must always be sufficient to move the adjusting lever to such an extent that the positioning-lever stop makes reliable contact with the rated-speed adjusting screw.



FUNCTIONAL TEST (MLD)

Prerequisite:

- Pump adjusted and assembled.

- Ball-pin spacing for hydraulic damper set.

If the lever assembly is set correctly, the sequence of movements is as follows when the control lever is deflected.

Move control lever until damping spring is over-compressed.

Idle-motion spring must not be influenced in this lever position.

Continue moving control lever until idle-motion spring is over-compressed.

In this lever position the intermediate lever is still in contact with the residual-quantity stop screw.
Continued movement of the lever lifts the intermediate lever off the residual-quantity stop screw.

Instructions : W-460/506

BOSCH system : VE..F..

Basic microcard : W-400/012

Section | Coordinates





## SPECIAL FEATURES

This microcard deals with testing and repair of the

* Distributor-type fuel-injection pump with temperature-controlled cold start acceleration device (KSB).

It is based on the detailed test instructions W-400/012.

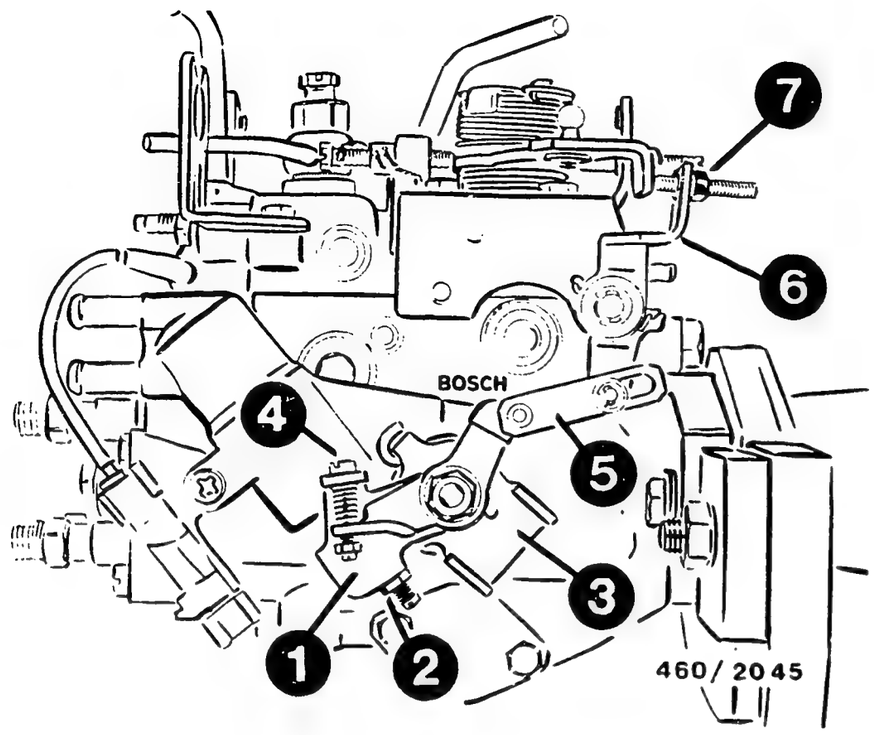
## TEST SPECIFICATIONS

Settings for KSB stroke:

| Temperature | Stroke |
|---|---|
| + 15°C | 0.25 mm |
| + 20°C | 0.15 mm |
| + 25°C | 0.05 mm |

Gap between idle-speed adjusting screw and speed-control lever.

| Temperature | Gap |
|---|---|
| + 15°C | 1.3 mm |
| + 20°C | 1.1 mm |
| + 25°C | 0.9 mm |
| + 30°C | 0.7 mm |

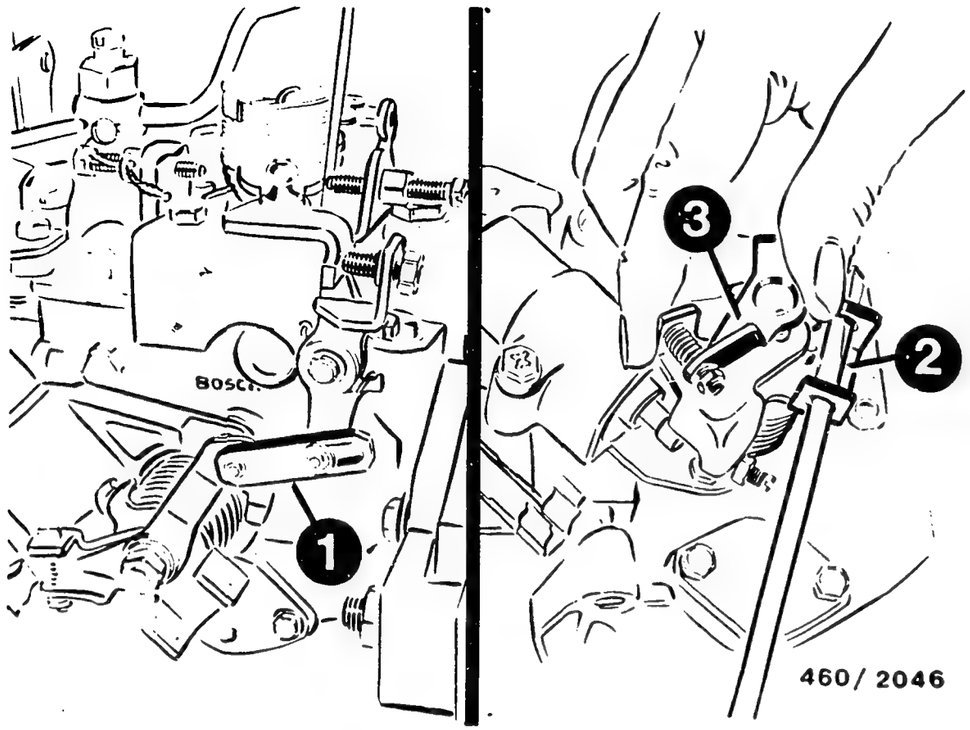



1 = KSB lever
2 = Travel adjusting screw
3 = Tensioning lever
4 = Intermediate-lever adjusting screw
5 = Connecting link
6 = Intermediate lever
7 = High-idle adjusting screw

COMPONENTS OF THE TEMPERATURE-CONTROLLED COLD START ACCELERATION DEVICE (KSB)

TESTERS AND TOOLS

| | |
|---|---|
| Timing-device measuring tool | 1 688 130 139 |
| Dial-indicator holder | KDEP 1088 |
| Dial indicator | 1 687 233 012 |
| Driving coupling | 1 686 430 023 |
| Torque wrench | 0...20 Nm |
| Injection-pump test bench | |




1 = Connecting link
2 = Tensioning lever
3 = KSB lever

DISASSEMBLING COLD START ACCELERATION DEVICE

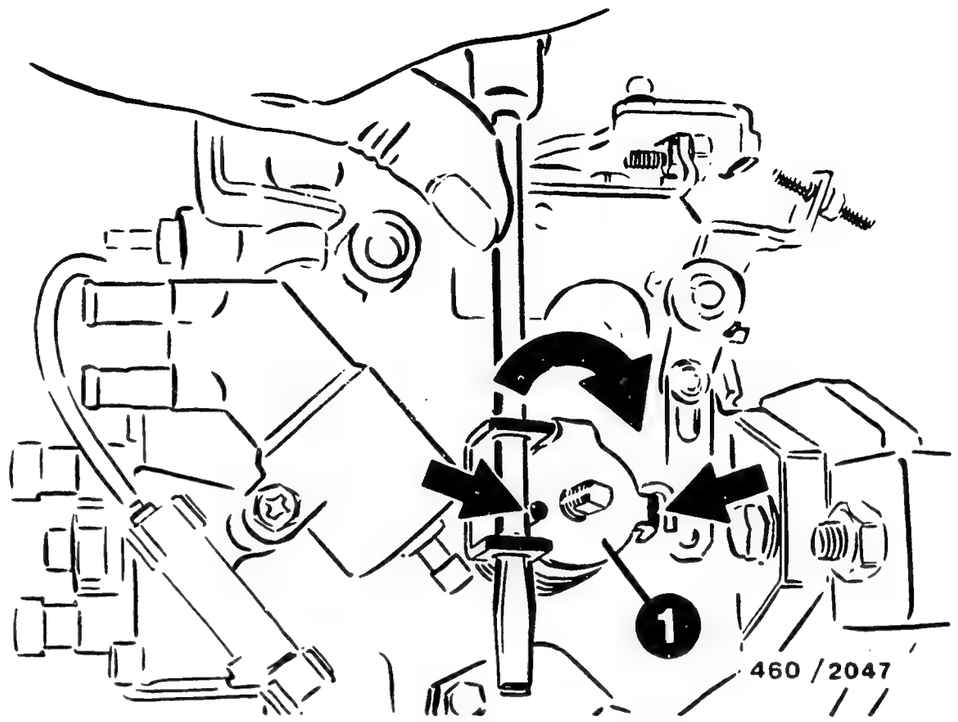
* Renew expansion element
* Eliminate leaks

Procedure:
Remove connecting link between KSB lever and intermediate lever.
Insert suitable tool (screwdriver) into tensioning lever and pre-tension KSB spring somewhat.

Remove KSB lever with intermediate-lever adjusting screw and release tensioning lever.

Remove tensioning lever and KSB springs.
Check parts for wear and renew if necessary.





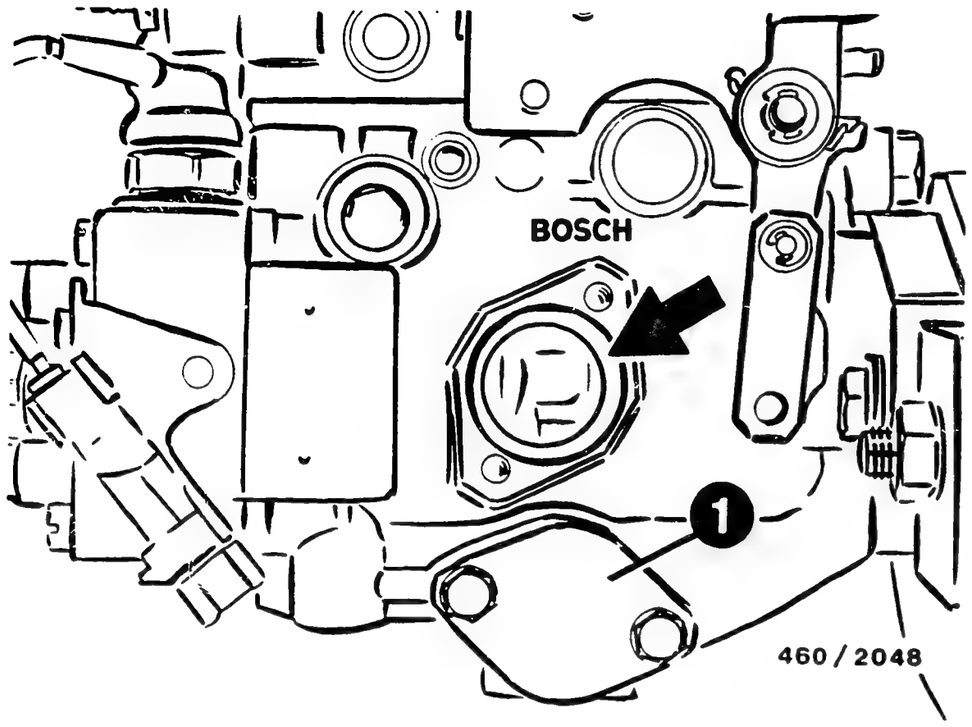

1 = Tensioning lever

ASSEMBLING COLD START ACCELERATION DEVICE

Turn KSB setting shaft in clockwise direction until eccentric makes contact with contact surface at cam roller ring.
Loosen timing-device closing cover on spring side and release timing-device spring. Turn KSB setting shaft approx. 180° in counter-clockwise direction and fit KSB springs (end of outer spring on tensioning lever side).

Attach tensioning lever to KSB setting shaft such that ends of springs coincide with holding fixtures in tensioning lever (arrows).

Pre-tension KSB springs with tensioning lever approx. 180° (in clockwise direction) and attach KSB lever. Fit timing-device cover on spring side.




1 = Timing-device cover

TESTING AND ADJUSTING FUEL-INJECTION PUMP

Remove complete cold start acceleration device from fuel-injection-pump housing.

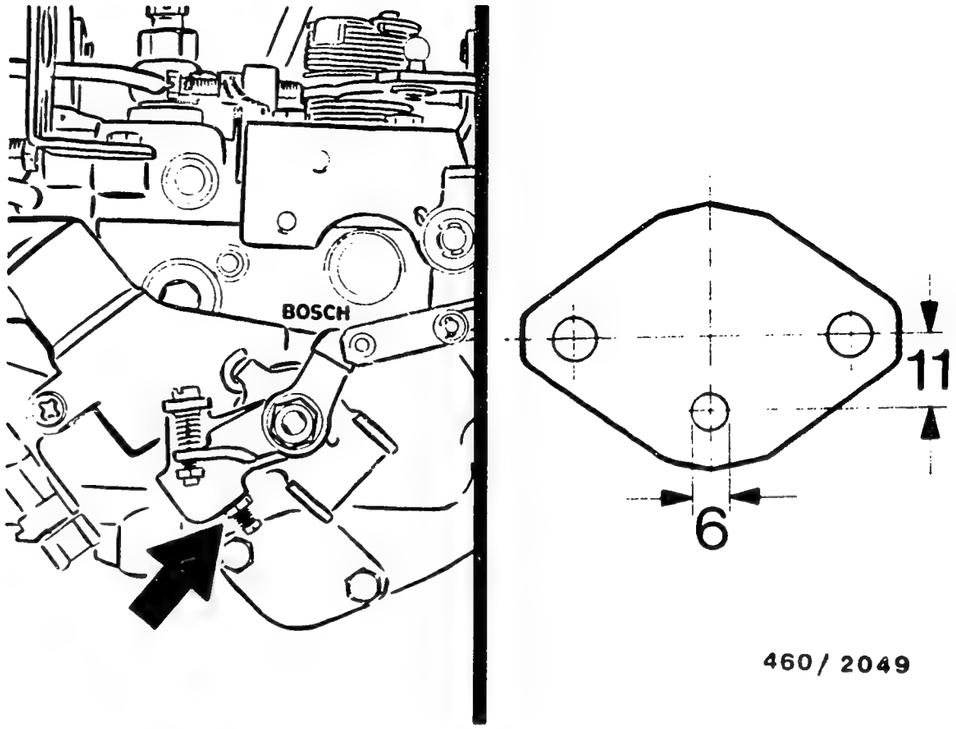
Detach timing-device cover from pressure side and thus seal installation opening (arrow) of cold start acceleration device.

Attach timing-device measuring tool. Install pump on test bench and adjust/test in accordance with test instructions.

Following completion of test, remove timing-device measuring tool.

Attach cold start acceleration device to pump housing.






Arrow = Travel adjusting screw

ADJUSTING COLD START ACCELERATION DEVICE

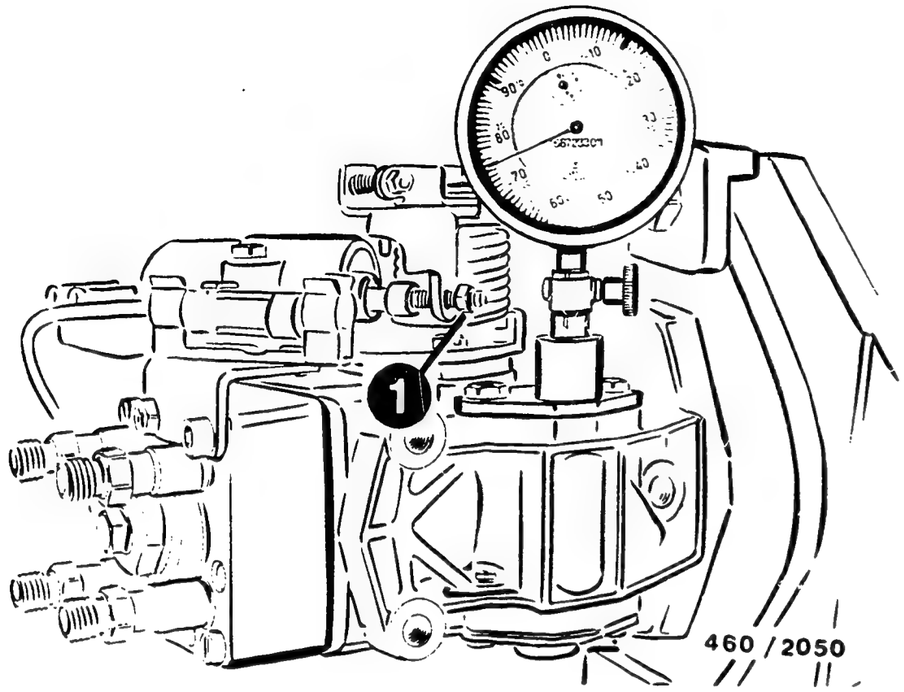
Adjustment conditions:

Cool pump down to ambient temperature.

Screw in travel adjusting screw to stop cold start acceleration device functioning.

Loosely insert dial indicator 1 687 233 012 in dial-indicator holder KDEP 1088 and pre-tension approx. 10 mm.

Drill additional timing-device cover (ex-stock) as shown in drawing.




Arrow = Travel adjusting screw

Fit drilled timing-device cover and ensure that timing-device piston makes contact with timing-device cover.

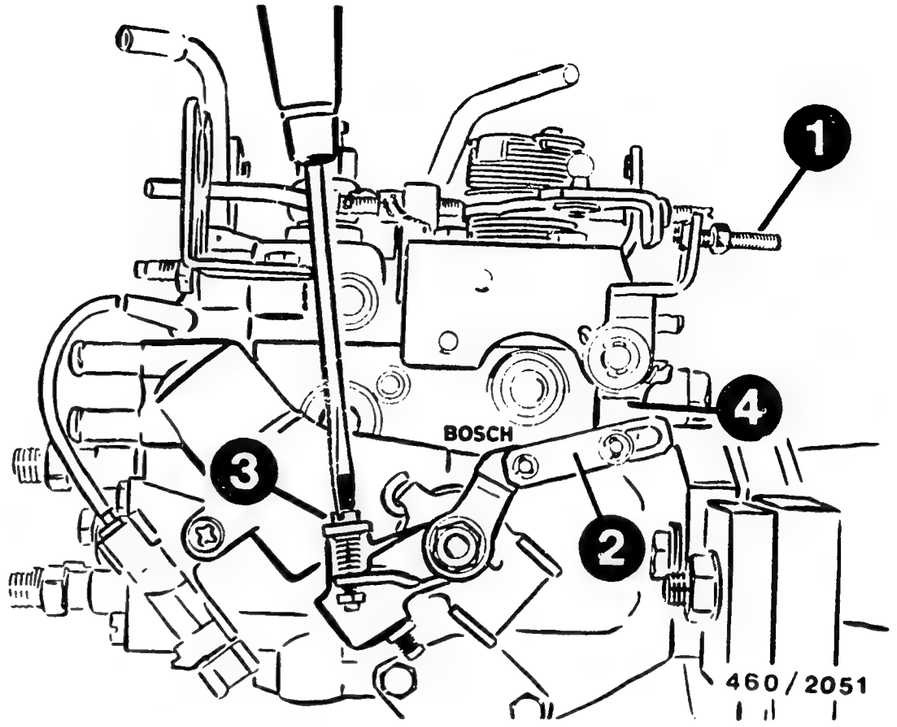
Attach dial-indicator holder to drilled timing-device cover such that dial indicator makes contact with timing-device piston.
Set dial indicator to 0 in this position.

Unscrew travel adjusting screw until KSB stroke determined from table is attained.
Determination of KSB stroke

| Temperature | Stroke |
|---|---|
| + 15°C | 0.25 mm |
| + 20°C | 0.15 mm |
| + 25°C | 0.05 mm |

N o t e :
When performing this operation, the drive shaft must be turned forward and back several times to overcome the friction of the cam roller ring.





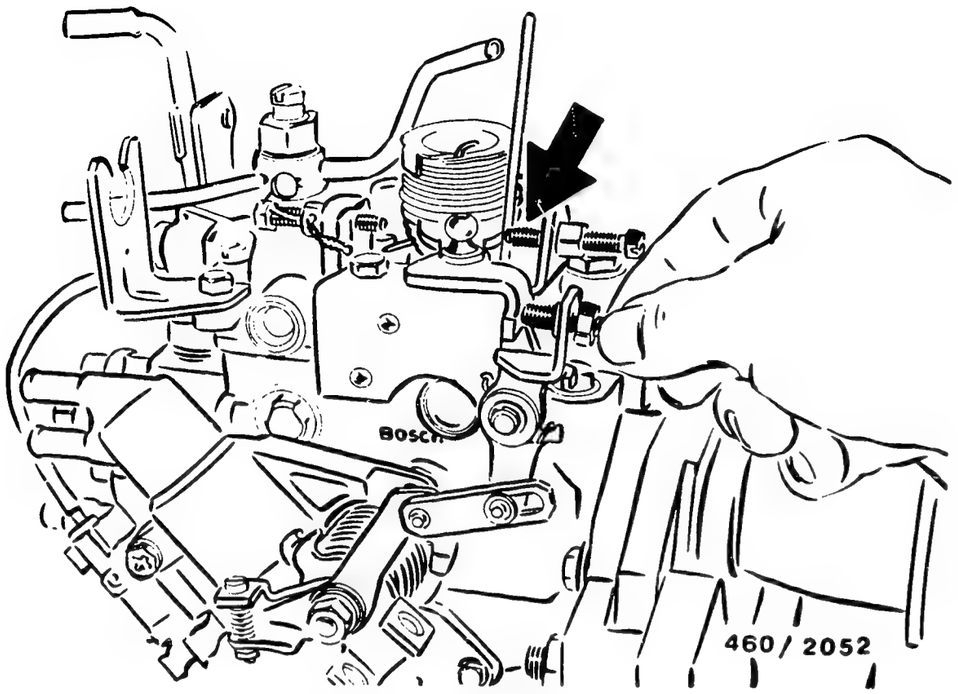

1 = Adjusting screw (high idle)
2 = Connecting link
3 = Intermediate-lever adjusting screw
4 = Intermediate lever

ASSIGNMENT OF INTERMEDIATE LEVER

Unscrew adjusting screw for high idle.

Attach connecting link.

Set intermediate lever with adjusting screw to adjustment mark.




Arrow = Idle adjusting screw

SETTING HIGH IDLE

Determine gap between adjusting screw and speed-control lever:

| Temperature | Gap |
|---|---|
| + 15°C | 1.3 mm |
| + 20°C | 1.1 mm |
| + 25°C | 0.9 mm |
| + 30°C | 0.7 mm |

Take temperature-dependent gap from table.

Insert feeler gauge between speed-control lever and idle adjusting screw.

Screw in adjusting screw until it makes contact with speed-control lever.
Setting complete.
Fully assemble pump and attach lead seal.

For production reasons:
continued on the following coordinate.

INSTRUCTIONS : W-460/306

BOSCH system : Setting hydraulic torque control and switching point (control valve, EGR) for VE distributor-type fuel-injection pumps

BASIC MICROCARD : W-400/012

| Section | Coordinates |
|---|---|




SPECIAL FEATURES

These brief instructions deal with testing and adjustment of VE-pumps with:

- Hydraulic torque control (HBA)
- Hydraulic KSB
- Locked timing
- Temperature-controlled idle-speed increase acting on housing-fixed idle spring
- Temperature-controlled cold-start acceleration device acting on cam roller ring.
- Part-load quantity stop for EGR
- Switching valve for setting switching point, EGR

TEST SPECIFICATIONS

- Presettings

Temperature-controlled idle-speed increase (TLA) acting on cam roller ring:

Distance between ball stud and speed-control lever
Engine warm: 12.7 mm

Distance between speed-control lever and idle-speed adjusting screw
Engine cold: 2.4...2.6 mm
(2.2...2.8) mm

Temperature-controlled idle-speed increase (TLA) acting on housing-fixed idle spring:

Distance between bracket and thermocouple hexagon nut
Engine cold 5.3...5.7 mm

## SPECIAL FEATURES (CONTINUED)

Assignment of speed-control lever to linkage, EGR valve:

Center of ball stud to center of governor shaft 41 mm

Distance between drive flange and center of ball stud with speed-control lever positioned at

Idle stop 74.2 mm

Distance between speed-control lever – idle stop and rated speed stop measured with respect to

Center of ball stud 22.5...25.5 mm

## TIGHTENING TORQUES

| | | |
|---|---|---|
| Hexagon nut | Coupling half | 90...95 Nm |
| Flat nut | Coupling half | 70...75 Nm |
| Locking screw | | 27...35 Nm |
| Bleeder screw | | 26...32 Nm |
| Expansion element of KSB | | 15...20 Nm |
| Central screw plug | | 70...90 Nm |
| Thermocouple, idle-speed increase | | 15...20 Nm |
| Control valve, EGR | | 2...3 Nm |
| Threaded pin in HBA | | 3...5 Nm |
| Ball stud – lever Spring-actuated power on/off damper | | 3...5 Nm |

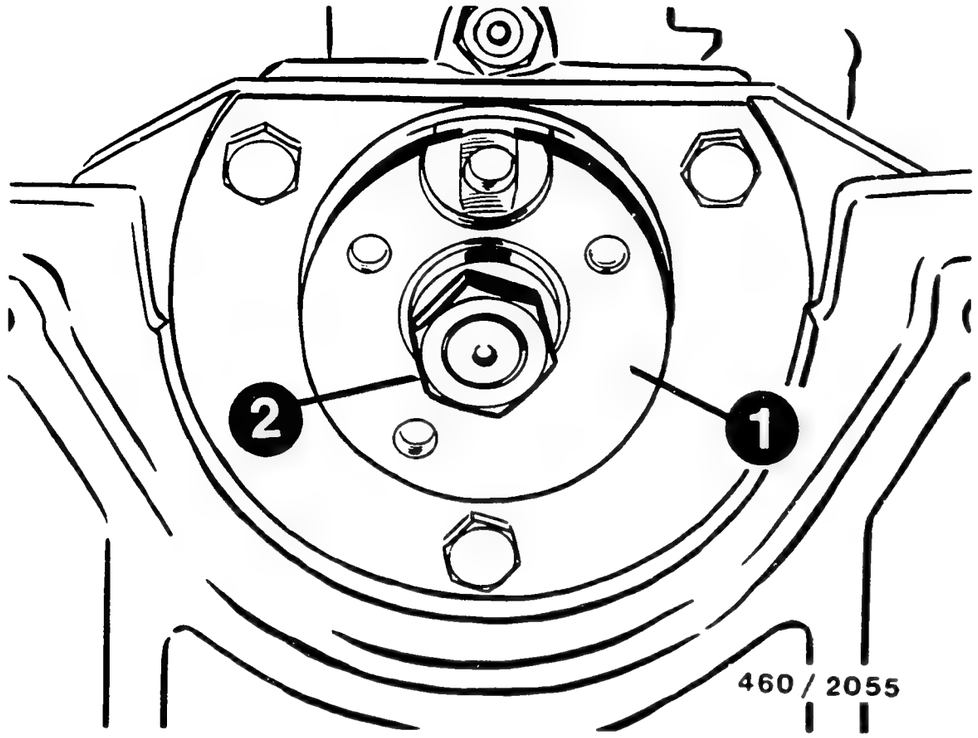
TESTERS AND TOOLS

| Designation | Part No. | Application |
|---|---|---|
| Drive coupling | 1 686 430 010 | Taper 20 mm |
| Setting mandrel | KDEP 1173 | Fixing drive shaft |
| Timing-device measuring instrument | KDEP 2601 | Measuring timing-device travel on spring end (pumps with HBA) |
| Timing-device measuring instrument | 1 688 130 139 | Measuring timing-device travel on delivery end (pumps with no HBA) |
| Timing-device cover | KDEP 1151 | Start-of-delivery setting in line with plunger lift |
| Clamping flange | 1 685 720 219 | Pilot 68 mm diameter |
| Extractor | Commercially available | Removal of coupling half |
| Centering sleeve<br>Measuring element | KDEP 1088/0/3<br>KDEP 1088/0/2 | Setting K1 dimension |
| Dial-indicator holder | KDEP 1088 | Setting K1 dimension |
| Dial indicator | 1 687 233 012 | Base thread M 3 |



TESTERS AND TOOLS (CONTINUED)

| Designation | Part No. | Application |
|---|---|---|
| Wrench | KDEP 1080 | For central screw plug |
| Spacer | KDEP 1176 | Setting part-load quantity for EGR |
| Adjusting screw | KDEP 1177 | Fixing control lever |
| Adjustment gauge | KDEP 1175 | Checking stop bracket |
| Spring tensioner | KDEP 1179 | Positioning control lever against spacer |
| Inlet-union screw with ring piece | 1 683 456 000<br>1 683 385 011 | Measuring overflow quantity and supply pump pressure |
| ALDA tester | 0 684 200 610 | Vacuum supply for setting switching point |
| Pressure/vacuum tester | 0 684 100 701<br>ETT 007.01 | Setting switching valve |
| Mityvac vacuum hand pump | KDJE-P500/18 | Setting switching valve |




1 = Coupling half
2 = Lock nut

REMOVING COUPLING HALF

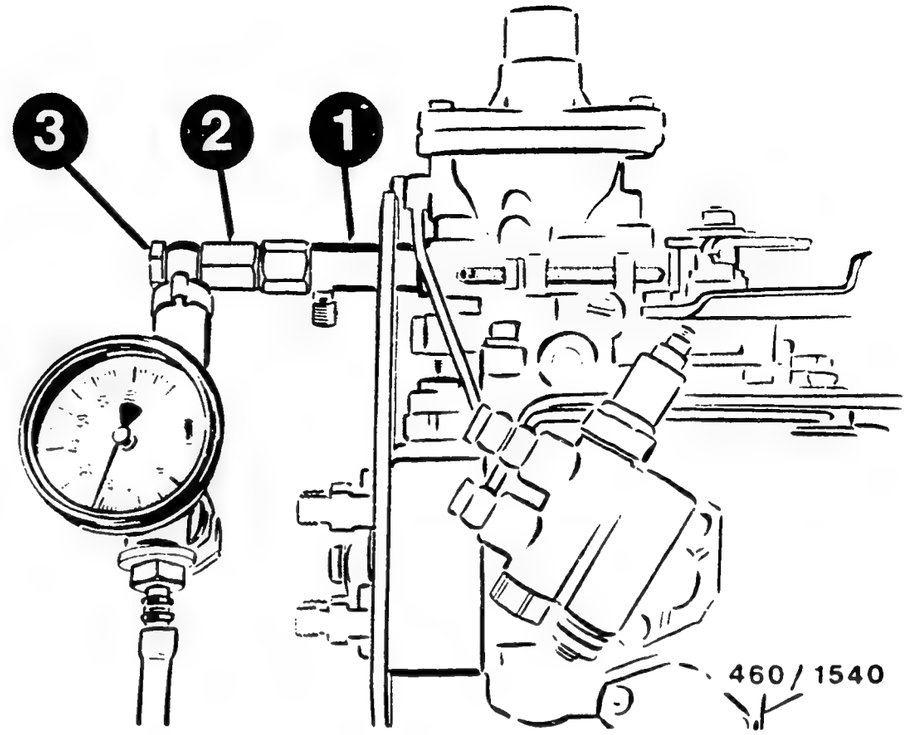
Loosen lock nut.

N o t e :
Do not counterhold at setting hole.

Press off coupling half using commercially available extractor.

Fit drive coupling and clamping flange.





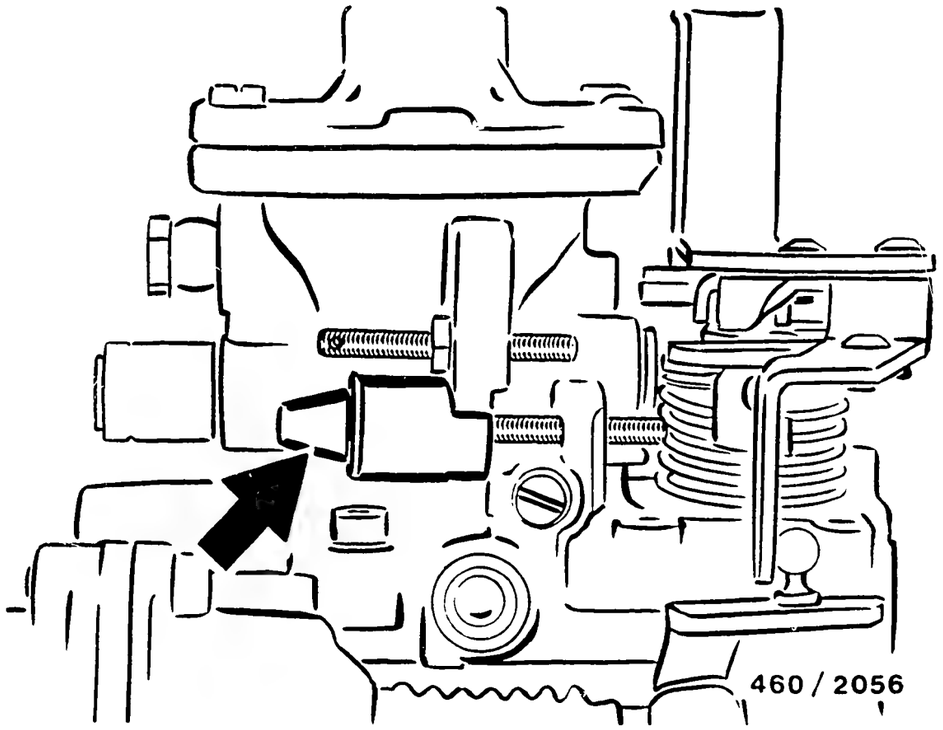

1 = Intermediate piece
(or use inlet-union screw 1 683 456 000
with ring piece 1 683 385 011)
2 = Original overflow restrictor
(part of pump)
3 = Inlet-union screw (not OUT screw)

PUMP-RETURN CONNECTION DIAGRAM

Fit intermediate piece at pump return.

Screw in original overflow restrictor with steel ring.

Connect up inlet-union screw and temperature indicator.




Arrow = retainer

TESTING AND ADJUSTING VE – PUMP WITH:

–Hydraulic torque control (HBA)
–Temperature–controlled cold–start acceleration device acting on cam roller ring and temperature–controlled idle–speed increase (TLA)

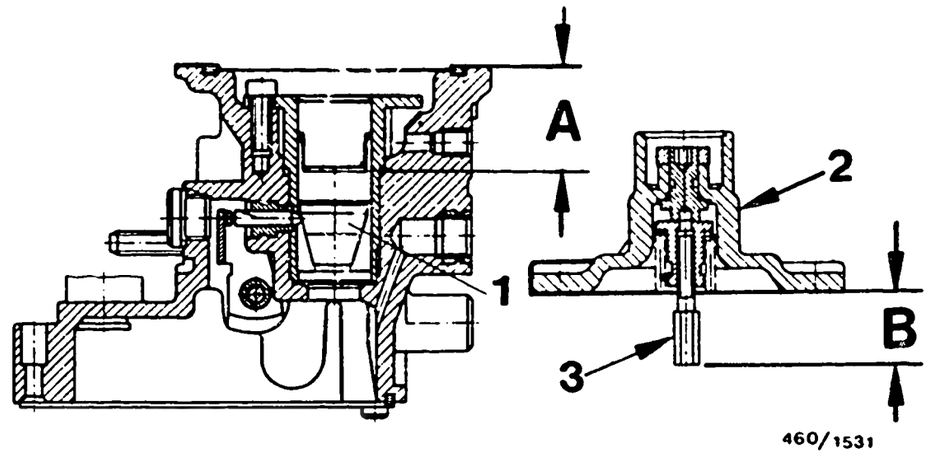
The following text blocks refer to work on the hydraulic torque control (HBA)

If no calibration work is required on the HBA (e.g. on performance of incoming pump inspection) proceed after Coordinate D11

CALIBRATING HYDRAULIC TORQUE CONTROL (HBA)

Remove retainer at rated–speed adjustment screw.
Unscrew sleeve.
Detach HBA housing from pump.






1 = Adjusting pin
2 = Counter nut
3 = Threaded pin

CALIBRATING HBA STROKE

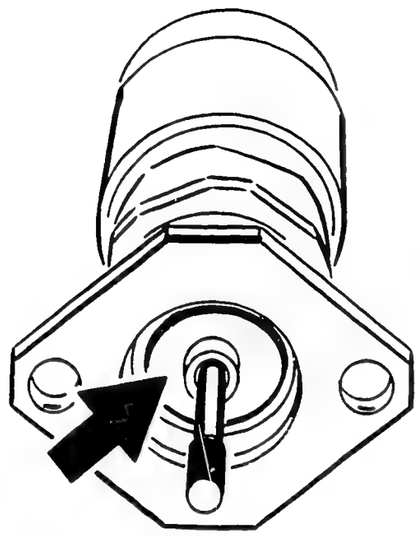
Adjustment procedure:

Unscrew HBA cover.

Press adjusting pin downwards against stop housing.
Measure dimension "A".
Turn threaded pin until dimension B = A – HBA stroke (in accordance with test–specification sheet) is obtained.

In this position, tighten threaded pin with counter nut.
Tightening torque 3...5 Nm.

Assemble HBA housing and attach to pump.



460/2057

PREPARING PUMP BEFORE TESTING

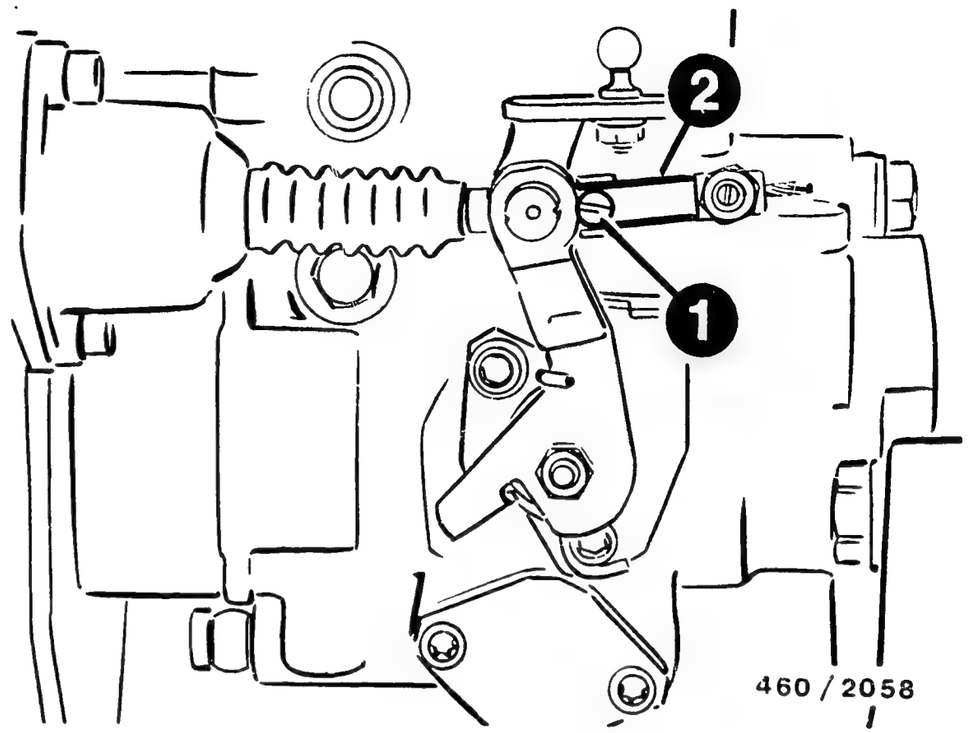
Attach fuel-injection pump with necessary test equipment to injection-pump test bench.

- Attach timing-device measuring instrument KDEP 2601 as follows:

Remove timing-device cover on spring side. Remove existing timing-device shims (hole 5.3 mm) from timing-device cover as well as internal shim in timing-device piston. Measure overall shim thickness.

Fit shims (hole 7.3 mm) from parts set 1 460 100 904 with same shim thickness in timing-device piston and timing-device measuring instrument (arrow). Mount timing-device measuring instrument with timing-device spring.






460/2058

1 = Clamping screw
2 = Intermediate piece

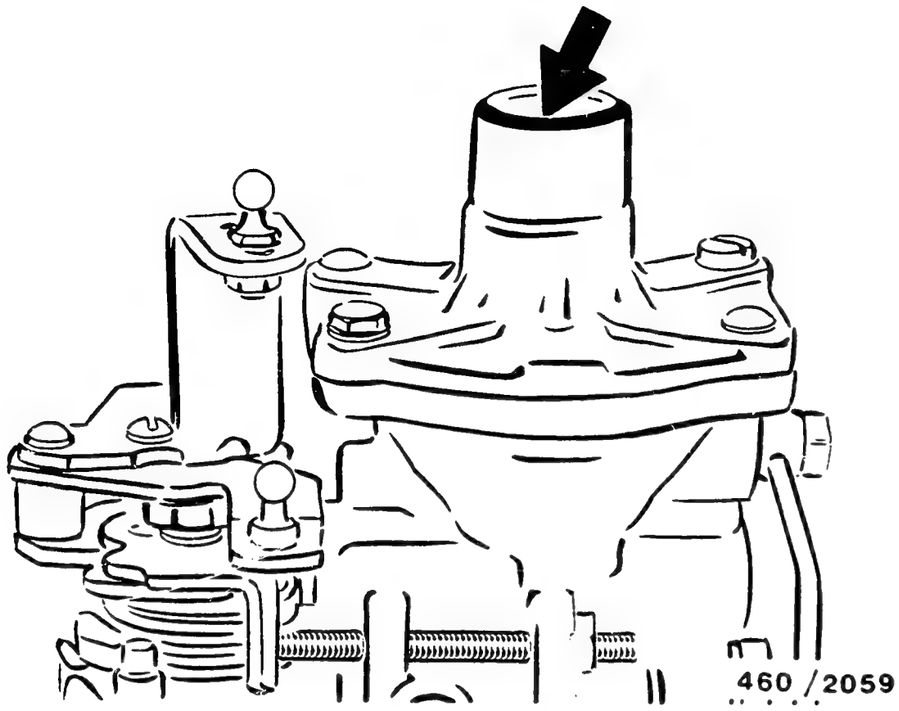
- Switch off KSB control device:

Loosen clamping screw.

Pull intermediate piece with KSB control lever in direction of distributor head.

Turn intermediate piece through 90° and push it back again in direction of drive shaft until KSB control lever makes contact with stop bracket.

The control device is disconnected in this position.




Arrow = HBA adjusting screw

- Set supply pump pressure and timing-device profile:

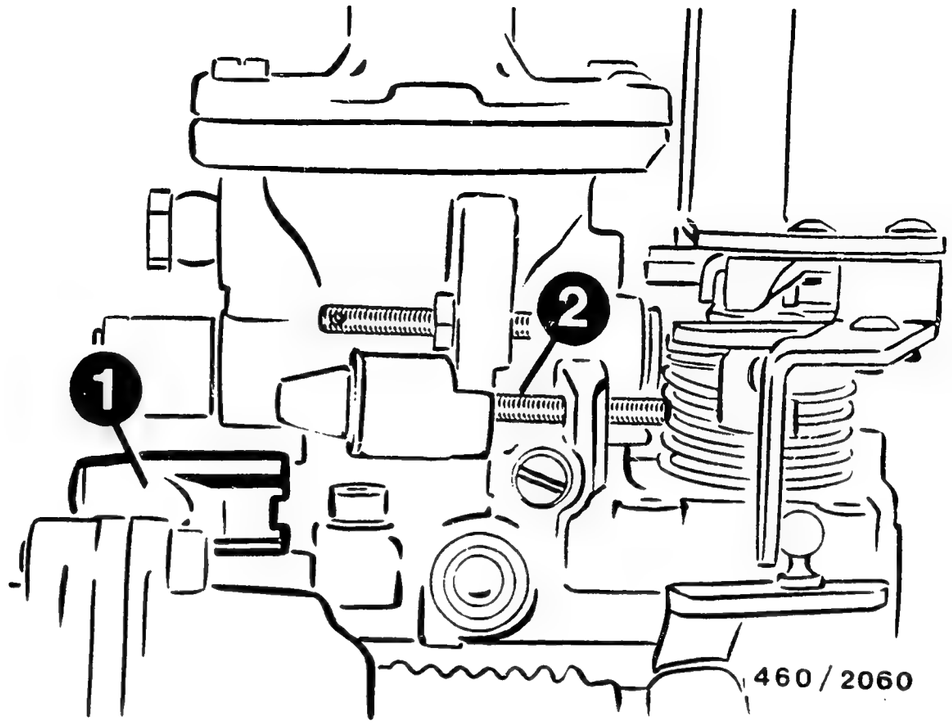
Turn HBA adjusting screw in a counter-clockwise direction until mechanical stop is felt. (Subject HBA spring to max. initial tension).

Approach adjustment points for supply pump pressure and timing-device travel.

Set supply pump pressure.

If the prescribed timing-device travel is not attained utilizing the supply-pump-pressure tolerance, correct by way of timing-device shims.






1 = Securing cap
2 = Rated-speed adjusting screw

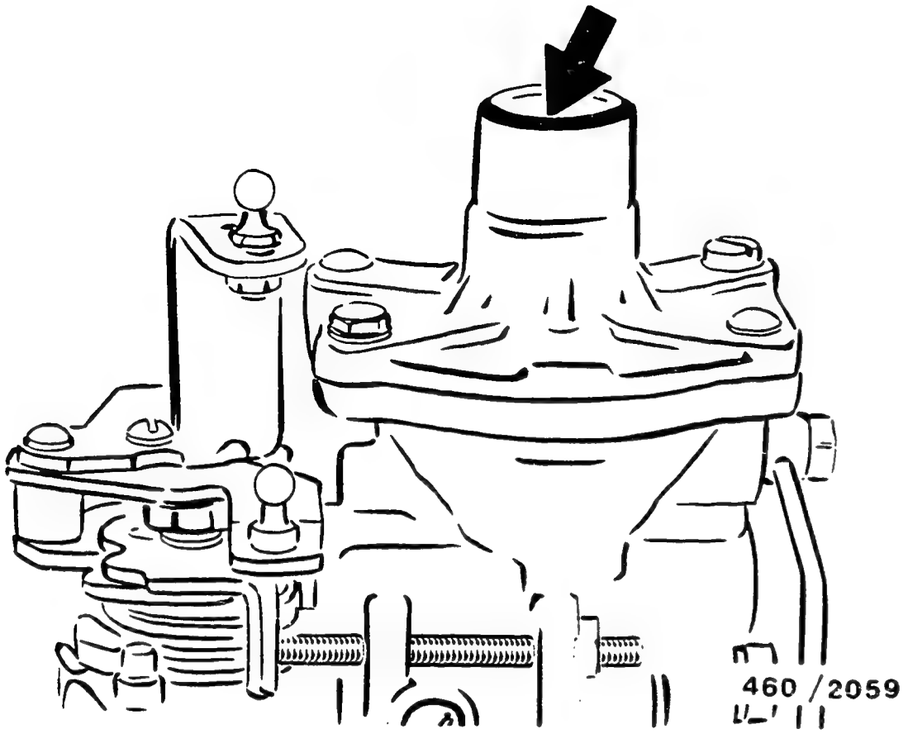
- Set deliveries:

Remove securing cap at full-load adjusting screw.

Approach minimum full-load speed "F" and pre-adjust full-load delivery at full-load adjusting screw. (Indicated in test-specification sheet under delivery data)

Set idle delivery.

Set full-load speed regulation point at rated-speed adjusting screw.




Arrow = HBA adjusting screw

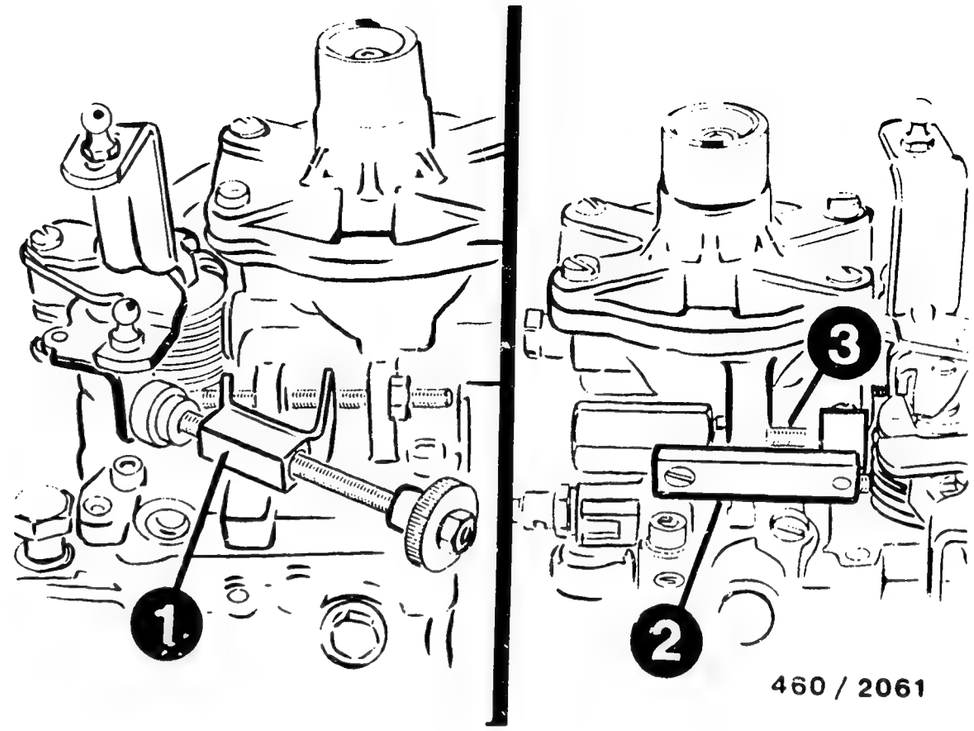
Approach full-load point "E" and measure delivery.

Set delivery with HBA adjusting screw.

Approach maximum full-load point "D" and measure delivery.

Check HBA stroke if measured delivery is <u>too low</u>.





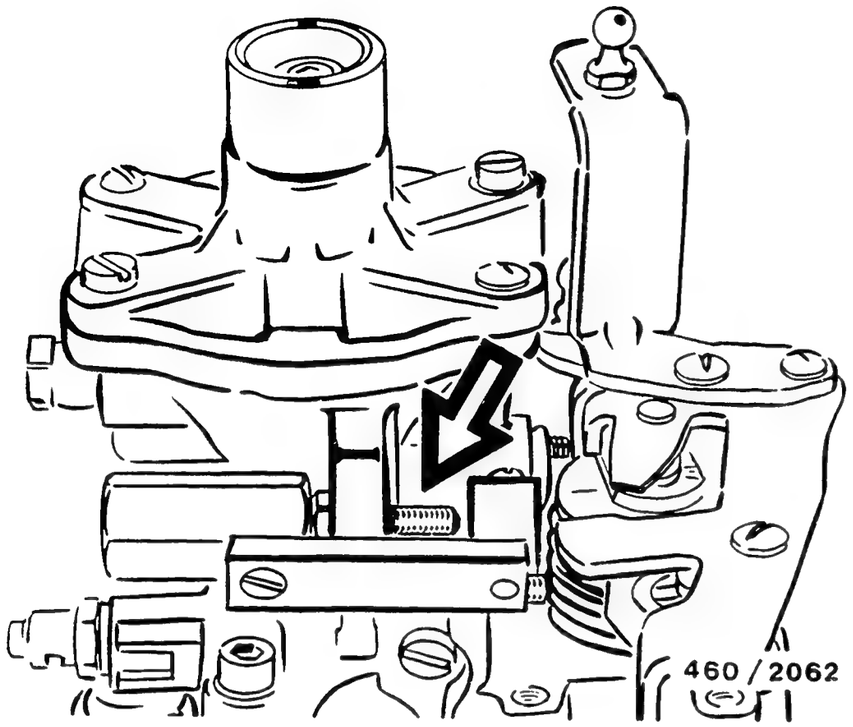

1 = Adjusting screw KDEP 1177
2 = Spacer KDEP 1176
3 = Part-load quantity adjusting screw

SETTING PART-LOAD QUANTITY (EGR RATE):

Insert adjusting screw KDEP 1177 between speed-control lever and stop of rated-speed adjusting screw.

Push spacer KDEP 1176 with 11.8 mm spacing on to part-load quantity adjusting screw.

Make up difference with respect to setting (in accordance with test-specification sheet).




Arrow = Part-load quantity adjusting screw

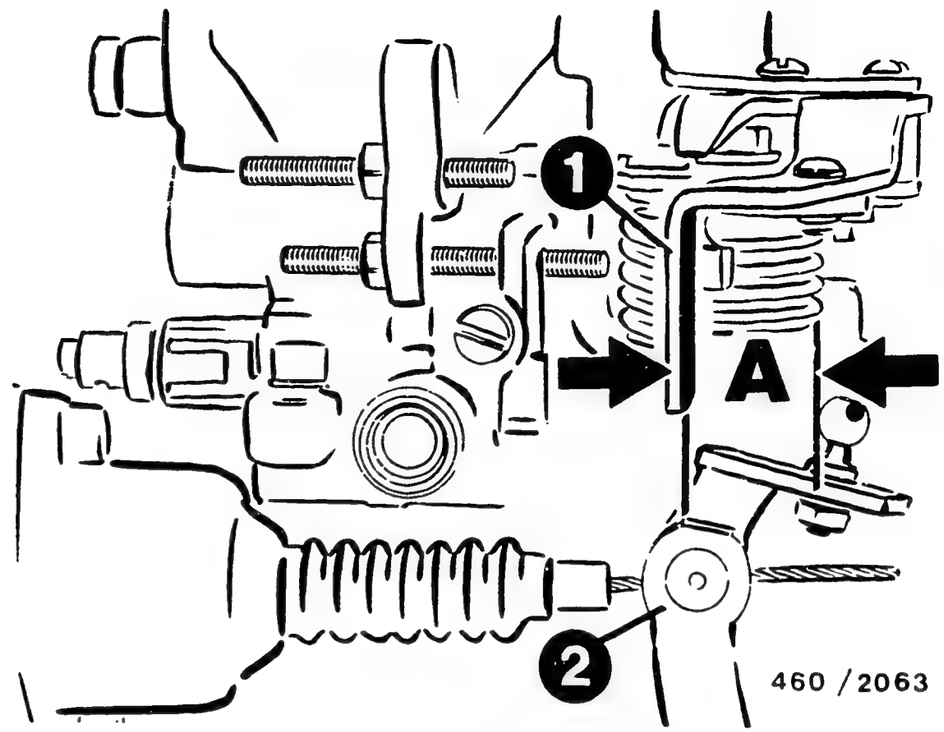
Position speed-control lever against spacer by way of knurled screw.

Approach part-load quantity speed and set delivery at part-load-quantity adjusting screw.

Remove timing-device measuring instrument KDEP 2601 and fit timing-device cover.

Detach drive coupling and slip onto drive shaft without lock nut.






1 = Speed-control lever
2 = KSB control lever

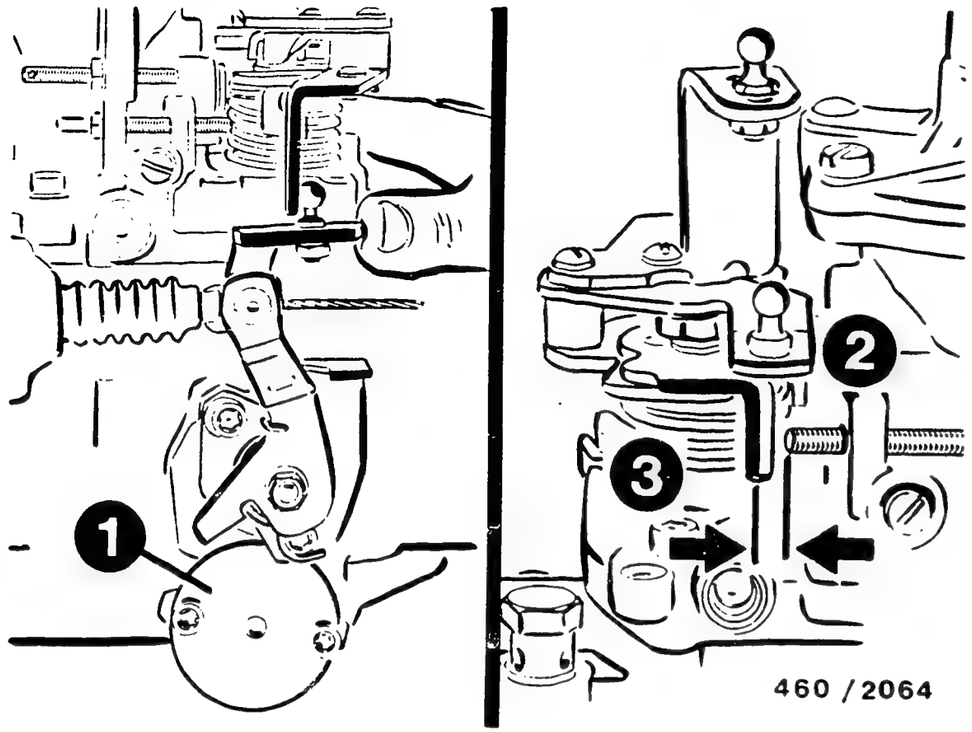
ADJUSTING TEMPERATURE-CONTROLLED COLD-START ACCELERATION DEVICE (KSB) WITH IDLE-SPEED INCREASE (TLA) ACTING ON CAM ROLLER RING

Prerequisite:
- Timing-device cover (original) fitted on delivery side.
- Control housing attached

Turn pump plunger to BDC position.

Adjust KSB control lever in direction of control housing as far as pressure point.

Measure distance "A" between ball stud and speed-control lever.
Set value: 12.7 mm
Adjust by shifting ball stud in slot area.




1 = Timing-device cover KDEP 1151
2 = Idle stop screw
3 = Speed-control lever

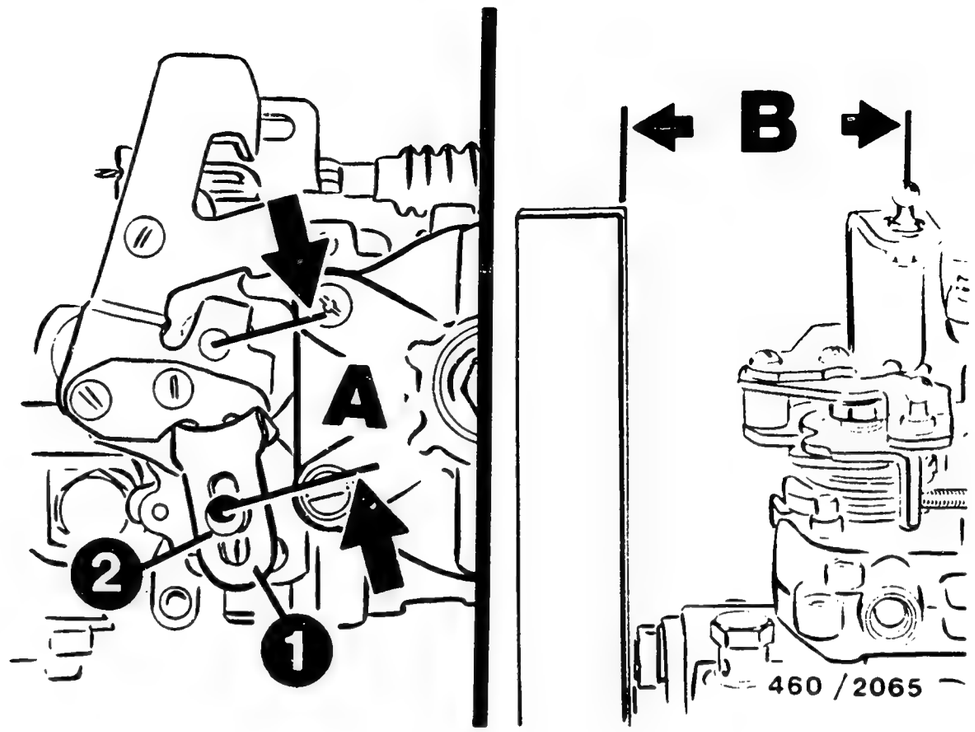
Remove timing-device cover (delivery side).

Attach timing-device cover KDEP 1151 with 3 mm collar.

Move KSB control lever in direction of control housing on cable plane as far as pressure point.

In this position the spacing between idle stop screw and speed-control lever must be 2.4...2.6 (2.2...2.8) mm.






1 = Mounting bracket
2 = Ball stud

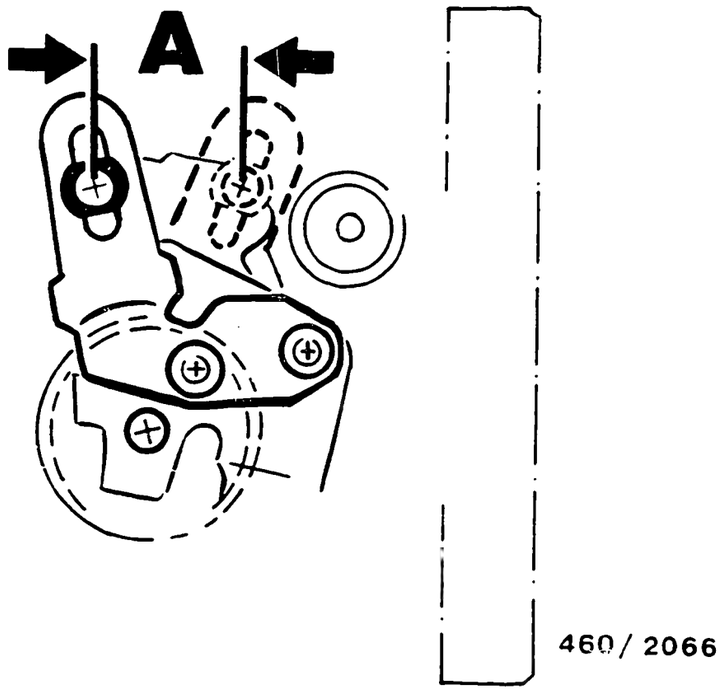
ASSIGNMENT OF BALL STUD AT SPEED-CONTROL LEVER TO EGR-VALVE LINKAGE

Position speed-control lever against idle stop.

Set ball stud fitted at mounting bracket to spacing "A"= 41 mm.

Measured from center of governor shaft to center of ball stud.

Measure distance between drive flange and center of ball stud at mounting bracket.
Spacing "B"= 66...74 mm




460/2066

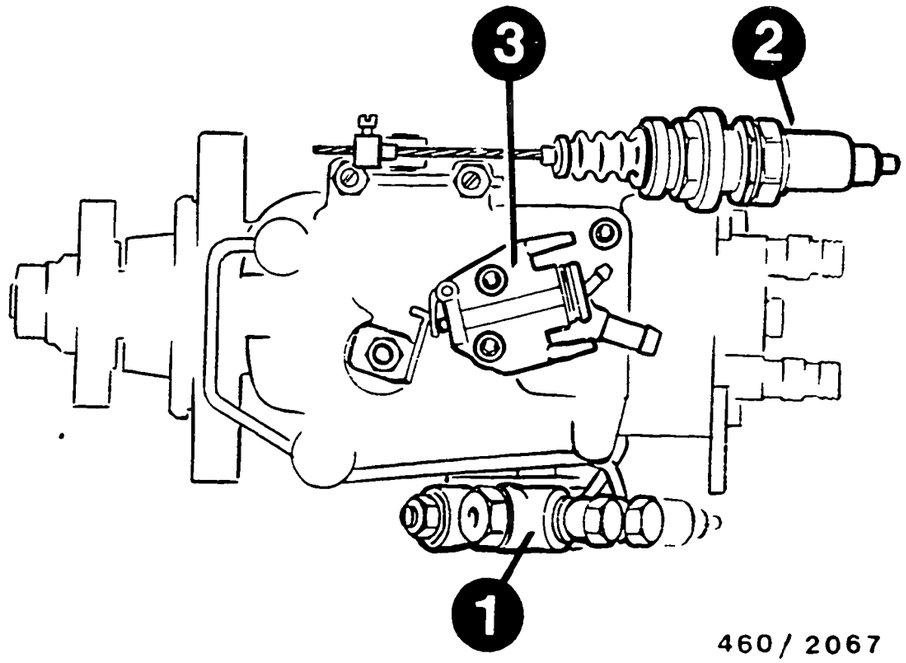
Position speed-control lever against rated-speed stop.

Measure travel "A" of ball stud (attached to mounting bracket) to rated-speed stop starting from idle stop.

Travel "A" = 22.5...25.5 mm

Set locked timing in accordance with Coordinate E19.






460/2067

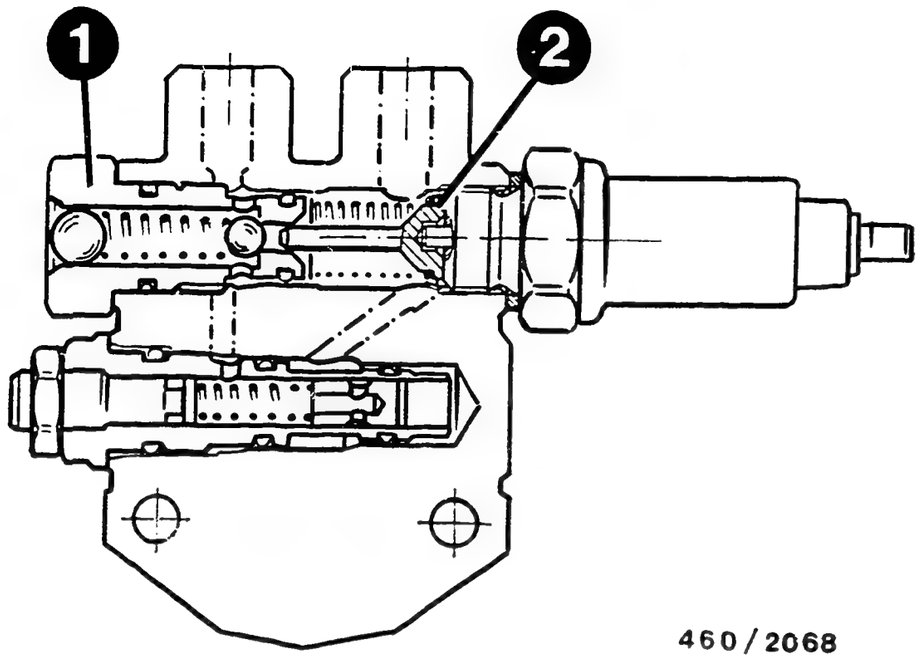
1 = Hydraulic cold-start acceleration device (KSB)
2 = Temperature-controlled idle-speed increase acting on housing-fixed idle spring (LFG)
3 = Switching valve for EGR

TESTING AND ADJUSTING VE-PUMP WITH:

-Hydraulic cold-start acceleration device (KSB)
-Switching valve for EGR
-Temperature-controlled idle-speed increase acting on housing-fixed idle spring (TLA)

Attach fuel-injection pump with necessary test equipment to injection-pump test bench.

Fit timing-device measuring instrument 1 688 130 139 on delivery side.
Testing and adjustment in accordance with test instructions
Refer to table of contents "Overview of Service Information - Products W400/000"
Differing adjustment procedures are described in the following.




460/2068

1 = Ball valve
2 = Thrust member

TESTING AND ADJUSTING KSB PROFILE "engine cold"

Marked with "A" and "B" in test-specification sheet in Section "Testing timing-device profile".

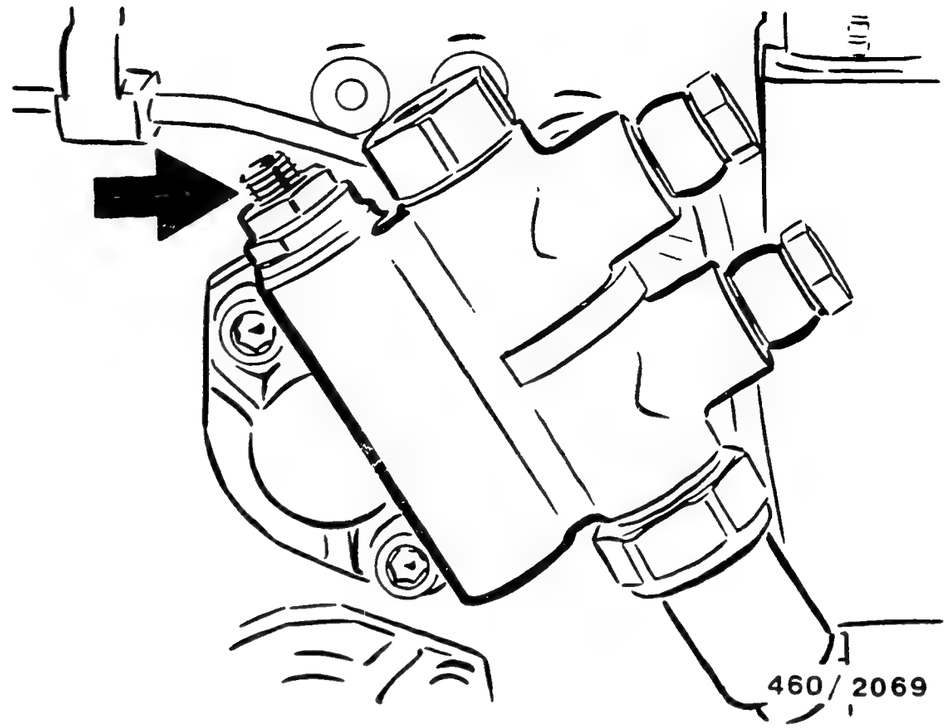
Prerequisite:

- Supply pump pressure and timing-device travel set.

Remove 12 volt voltage supply at expansion element.

Remove expansion element and thrust member.
Fit expansion element.





460/2069

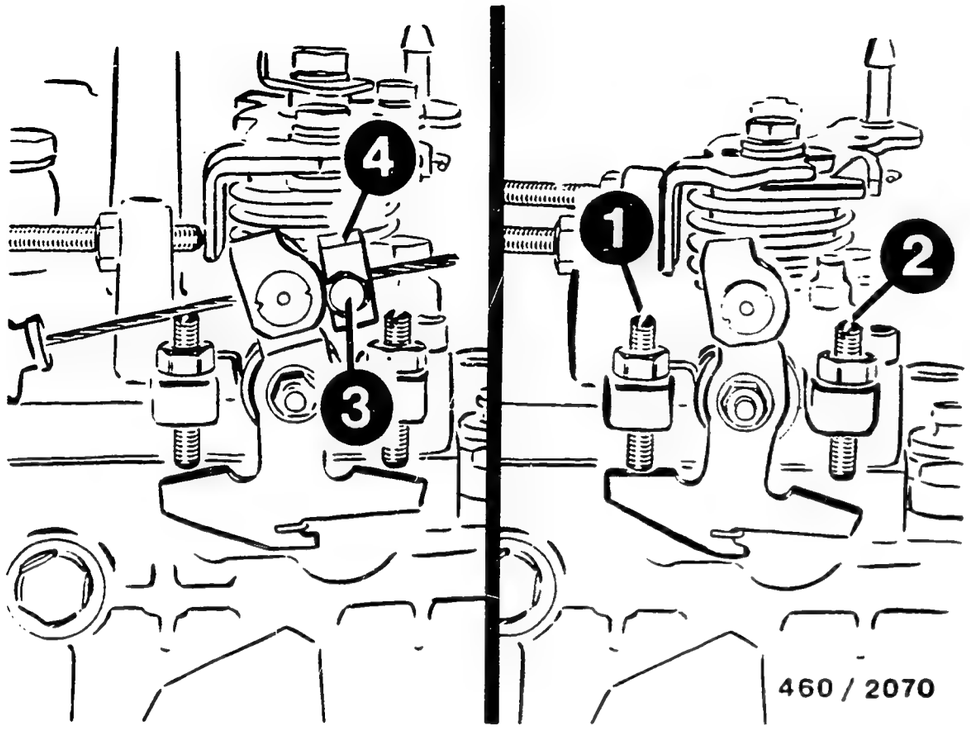
Arrow = Adjusting screw

Approach setting "A" for KSB and set timing-device travel if necessary by means of adjusting screw.

Approach point "B" and check KSB profile.

Fit thrust member.

Apply 12 volt voltage supply to expansion element and check timing-device profile.




1 = Idle-speed adjusting screw
2 = Stop screw for high idle
3 = Clamping screw
4 = Clamping piece

CHECKING IDLE SETTING

Prerequisite:

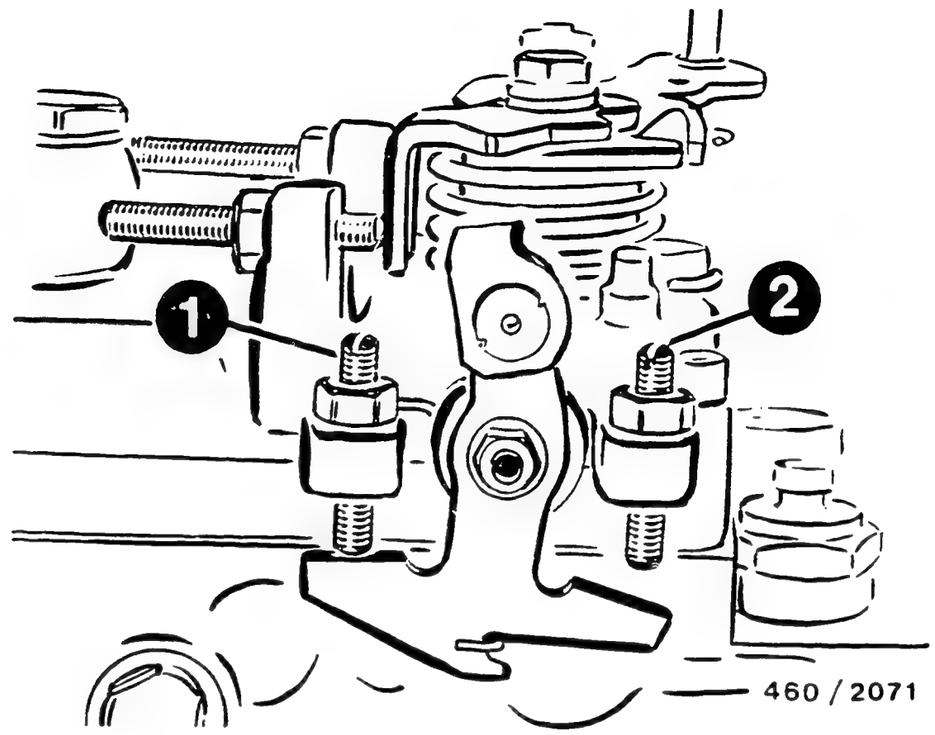
- Switch off temperature-controlled idle-speed increase.
  To do so, loosen clamping screw and remove clamping piece.

Position LFG stop lever against idle stop screw.

Approach speed and measure delivery.

Speed-control lever is positioned against residual-quantity stop.





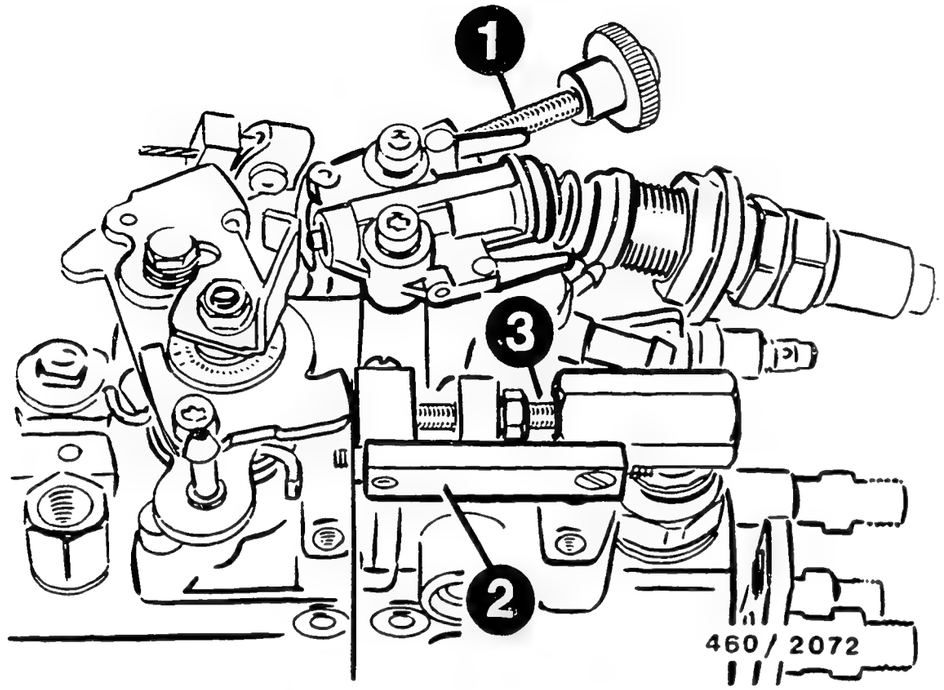

1 = Idle-speed adjusting screw
2 = Stop screw for high idle

TESTING HIGH IDLE

Position LFG stop lever against high idle stop.

Approach high idle speed and measure delivery.

Set delivery by means of adjusting screw.

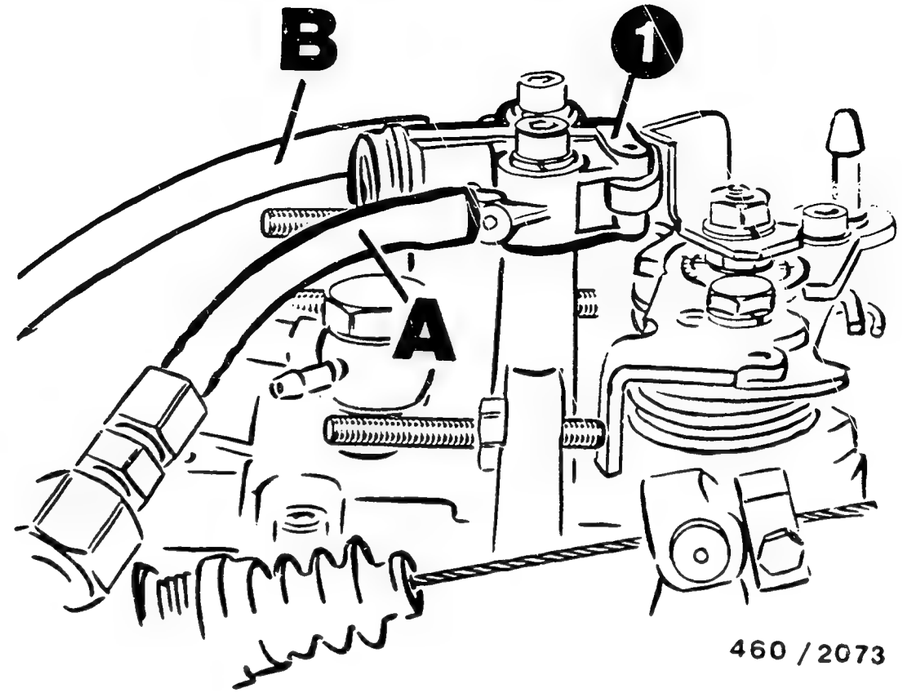



1 = Adjusting screw KDEP 1177
2 = Spacer KDEP 1176
3 = Part-load quantity adjusting screw

SETTING PART-LOAD QUANTITY (EGR RATE):

Insert adjusting screw KDEP 1177 between speed-control lever and stop – rated-speed adjusting screw.
Push spacer KDEP 1176 with 11.8 spacing on to part-load-quantity adjusting screw.
Make up difference with respect to setting (in accordance with test-specification sheet).
Position speed-control lever against spacer by means of knurled screw.
Approach speed for EGR rate and set delivery by way of part-load-quantity adjusting screw.
Remove timing-device measuring instrument and fit timing-device cover.
Detach drive coupling and push without lock nut on to drive shaft.





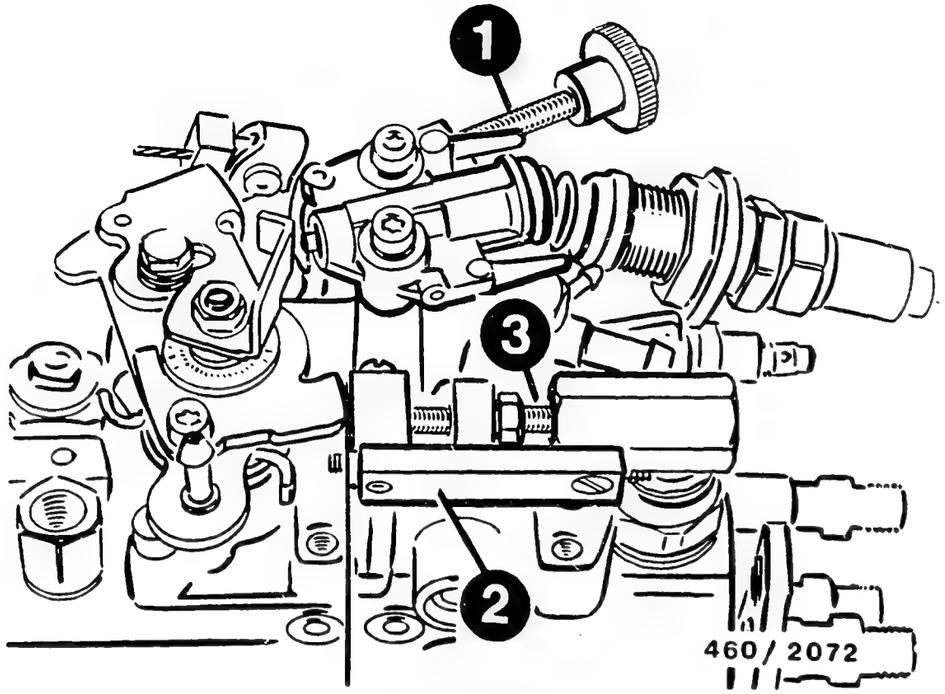

1 = Control valve
A = Connection "1" from ALDA tester
B = Connection "2" to vacuum gauge

SETTING SWITCHING POINT (EGR CONTROL VALVE)

- The following adjustment procedure is carried out with ALDA tester and pressure/vacuum tester.

- Adjustment procedure with Mityvac pump in accordance with Coordinate E06

Fit control valve on housing cover and tighten to prescribed tightening torque 2...3 Nm.
Apply 2.5 bar (air pressure) to pump.
Connect up connecting line of ALDA tester to marked connection "1" on control valve.
Connect up connection "2" to pressure/ vacuum tester.




1 = Adjusting screw KDEP 1177
2 = Spacer KDEP 1176
3 = Part-load-quantity adjusting screw

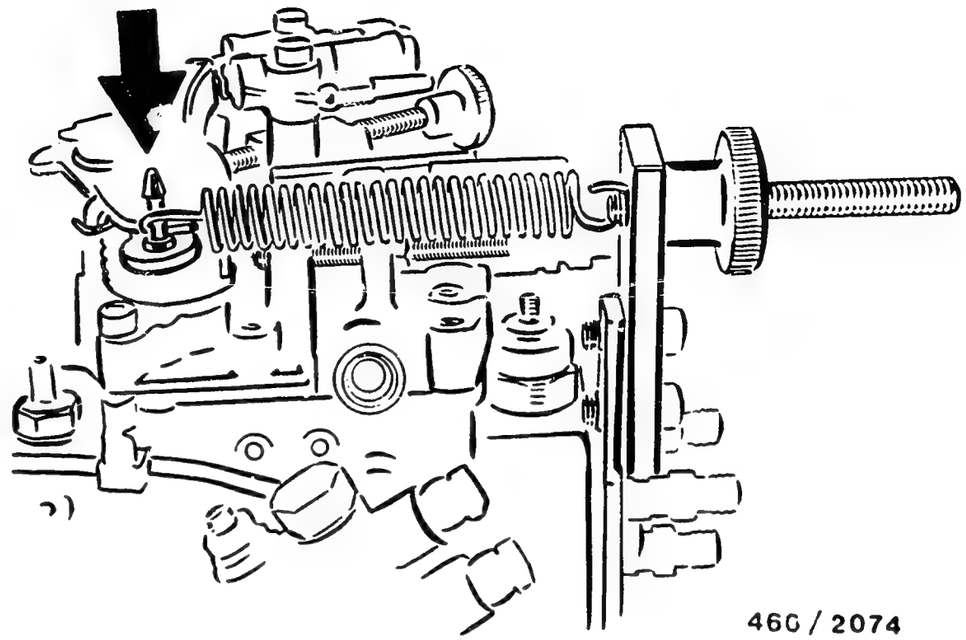
Insert adjusting screw KDEP 1177 between speed-control lever and stop – rated-speed adjusting screw.

Push spacer KDEP 1176 with 11.8 mm spacing on to part-load-quantity adjusting screw.

Position speed-control lever against spacer by way of knurled screw.

Make up difference with respect to setting in accordance with test-specification sheet.






Arrow = Driver

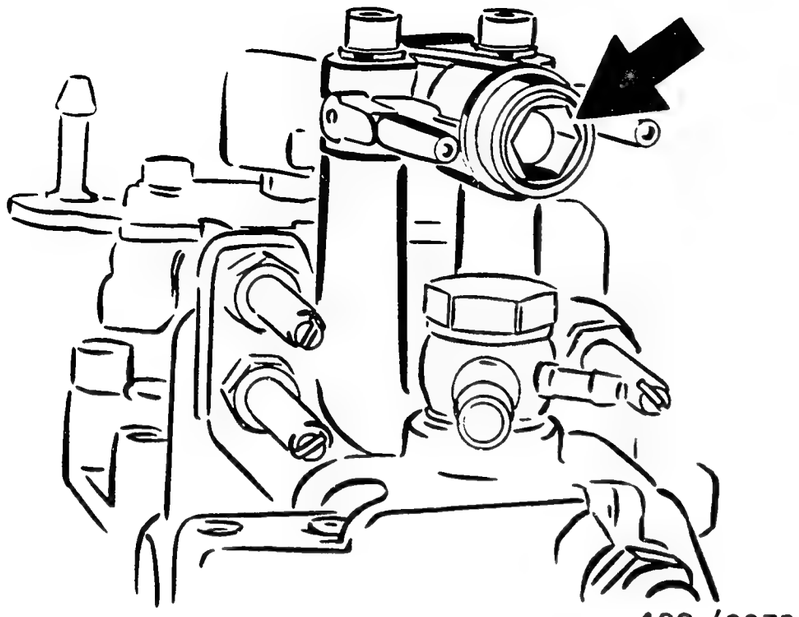
Set absolute pressure of 300 hPa by way of control throttle on ALDA tester.

Attach spring tensioner KDEP 1179 to bracket.

Insert extension spring in driver at speed-control lever.

Screw in knurled nut as far as it will go and tension extension spring.

This causes the speed-control lever to be pressed against the spacer.



460 /2075

Arrow = Control-valve adjusting screw

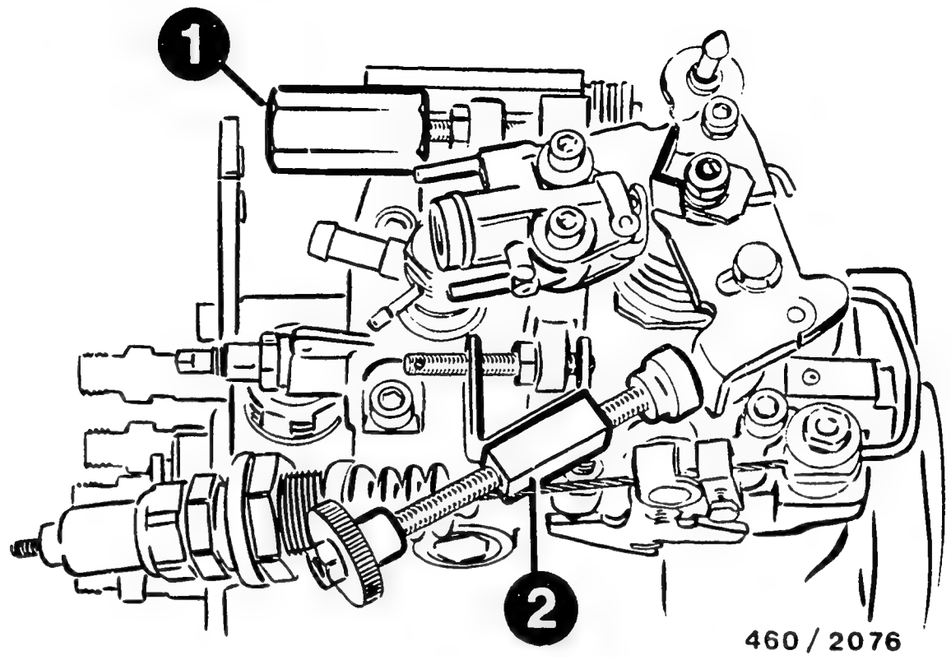
Set 350 hPa negative pressure (reading on pressure/vacuum tester) by way of adjusting screw (control valve).

Adjustment procedure:

With decreasing absolute pressure, adjust setting by turning adjusting screw in a counter-clockwise direction.

Only slight force may be exerted on the switching valve when doing so.






460 / 2076

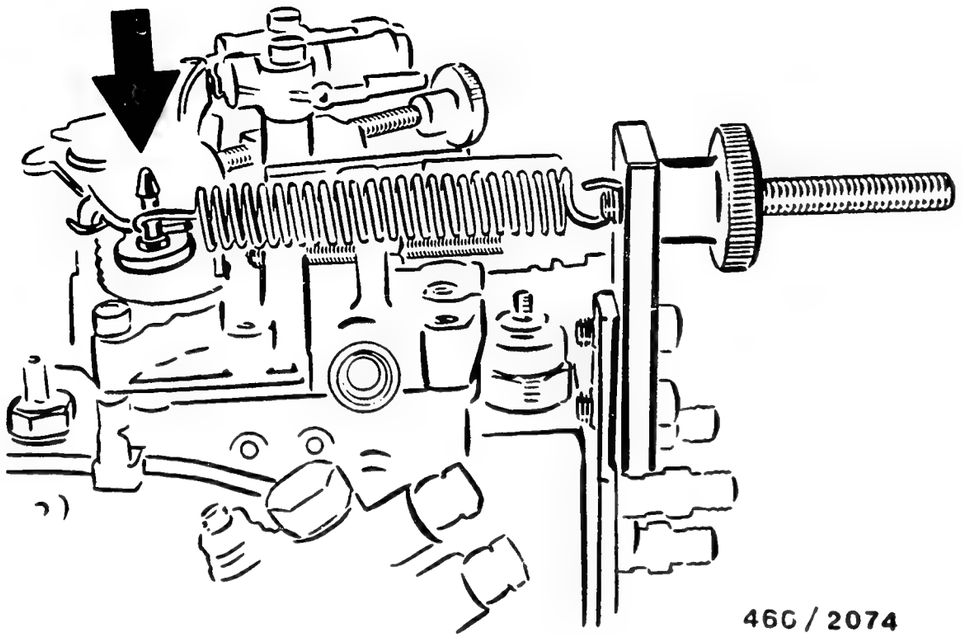
1 = Spacer
2 = Adjusting screw

CHECKING SWITCHING POINT SETTING

Position speed-control lever against idle stop.
Set reading on pressure/vacuum tester to 600 hPa negative pressure.
Briefly position speed-control lever against rated-speed stop.
Vacuum reading on
pressure/vacuum tester 0.0...200 hPa.

Measurement "1":
- With 11.8 mm spacing (produced by spacer)

Insert adjusting screw KDEP 1177.
Position speed-control lever slightly against spacer by way of adjusting screw.




Arrow = Driver

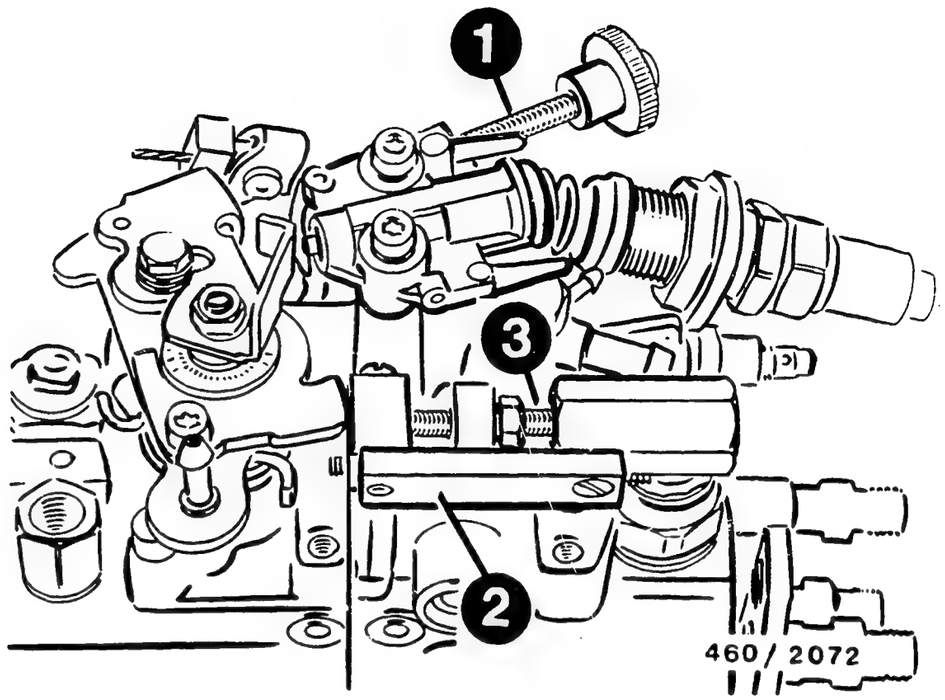
Insert extension spring in driver at speed-control lever.
Screw in knurled nut as far as it will go and tension extension spring.
Vacuum reading on pressure/vacuum tester 0.0...200 hPa.

Measurement "2":
- Spacing (in accordance with test-specification sheet)

Make up difference with respect to 11.8 mm spacing by means of feeler gauge and - under same conditions as those given for measurement "1" - press speed-control lever against spacer. Vacuum reading on pressure/vacuum tester 600 hPa.

If vacuum values are not attained, check angle position of stop bracket in accordance with Coordinate E11.



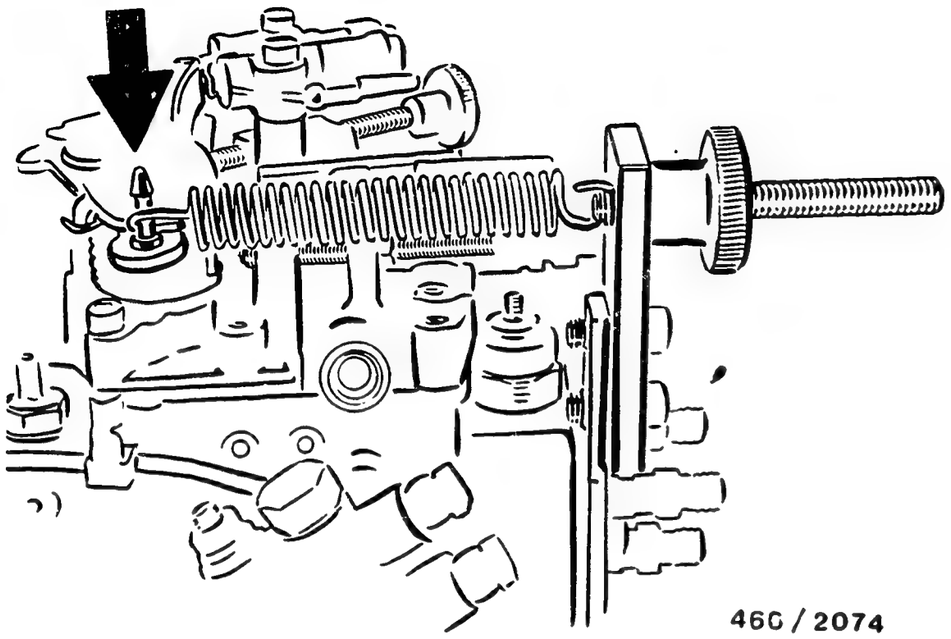



1 = Adjusting screw KDEP 1177
2 = Spacer KDEP 1176
3 = Part-load-quantity adjusting screw

ADJUSTING SWITCHING POINT

- The following adjustment sequence is performed with the Mityvac pump

Apply 2.5 bar (air pressure) to fuel-injection pump.
Connect Mityvac pump to connection "1" on control valve.
Connect up connection "2" to pressure/vacuum tester.
Insert adjusting screw KDEP 1177 between speed-control lever and stop for rated-speed adjusting screw.
Push spacer KDEP 1176 with 11.8 mm spacing on to part-load-quantity adjusting screw.
Make up difference with respect to setting (in accordance with test-specification sheet).
Position speed-control lever against spacer by way of knurled screw.



460 / 2074

Arrow = Driver

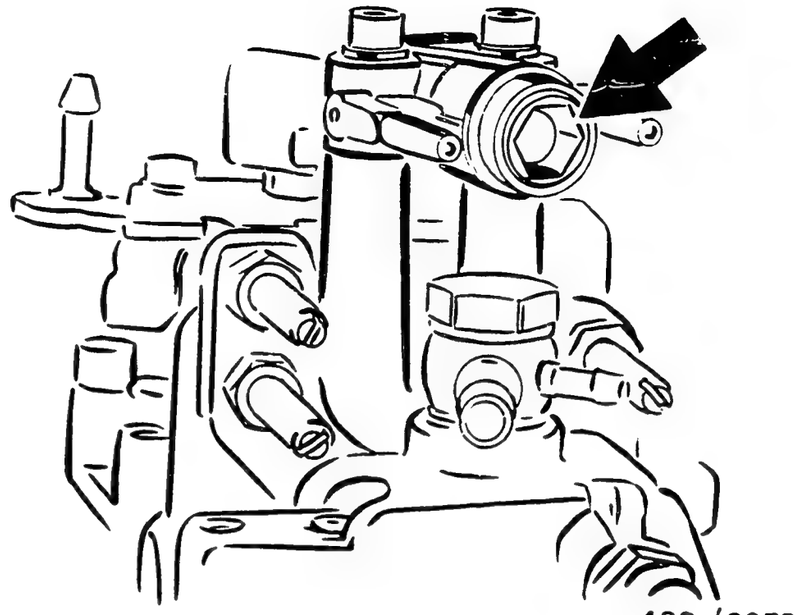
Attach spring tensioner KDEP 1179 to bracket.

Insert extension spring into driver at speed-control lever.

Screw in knurled nut as far as it will go and tension extension spring.

This causes the speed-control lever to be pressed against the spacer.





460 / 2075

Arrow = Adjusting screw (control valve)

Actuate Mityvac pump until a negative pressure of approx. 800 hPa is applied to pressure/vacuum tester.

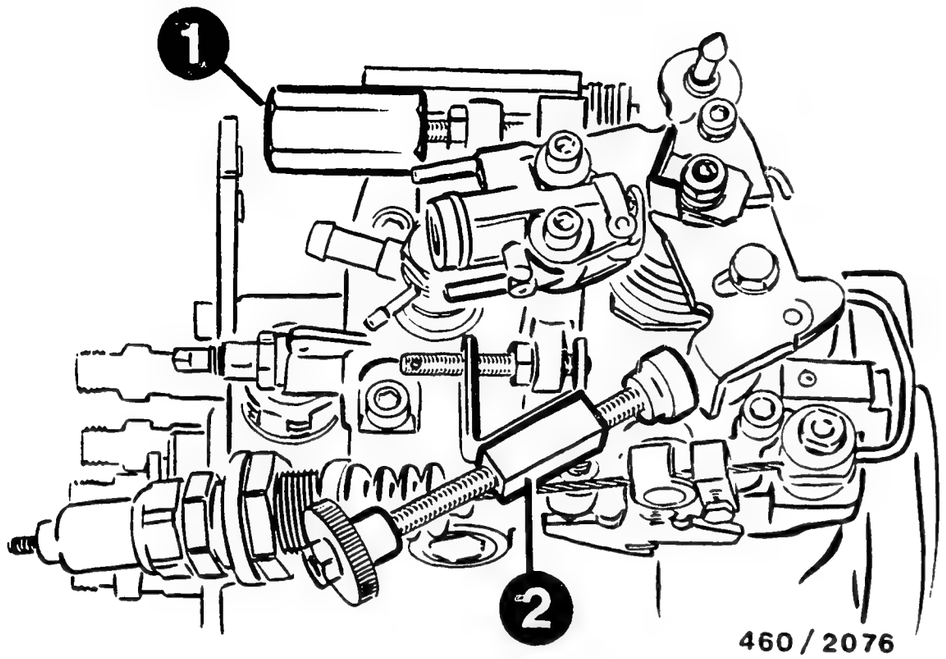
Set 350 hPa negative pressure (reading on pressure/vacuum tester) by way of adjusting screw (control valve).

Adjustment procedure:

Adjust setting by turning adjusting screw in counter-clockwise direction.

In doing so only slight force may be exerted on the switching valve.

N o t e:
Vent pressure/vacuum tester and Mityvac pump following each adjustment process.




1 = Spacer
2 = Adjusting screw

CHECKING SWITCHING POINT SETTING

Measurement "1":
– With 11.8 mm spacing (produced by spacer)

Insert adjusting screw KDEP 1177.

Position speed-control lever against spacer by way of adjusting screw.

Insert extension spring in driver at speed-control lever.

Screw in knurled nut as far as it will go and tension extension spring.

Vacuum reading 0.0...200 hPa.

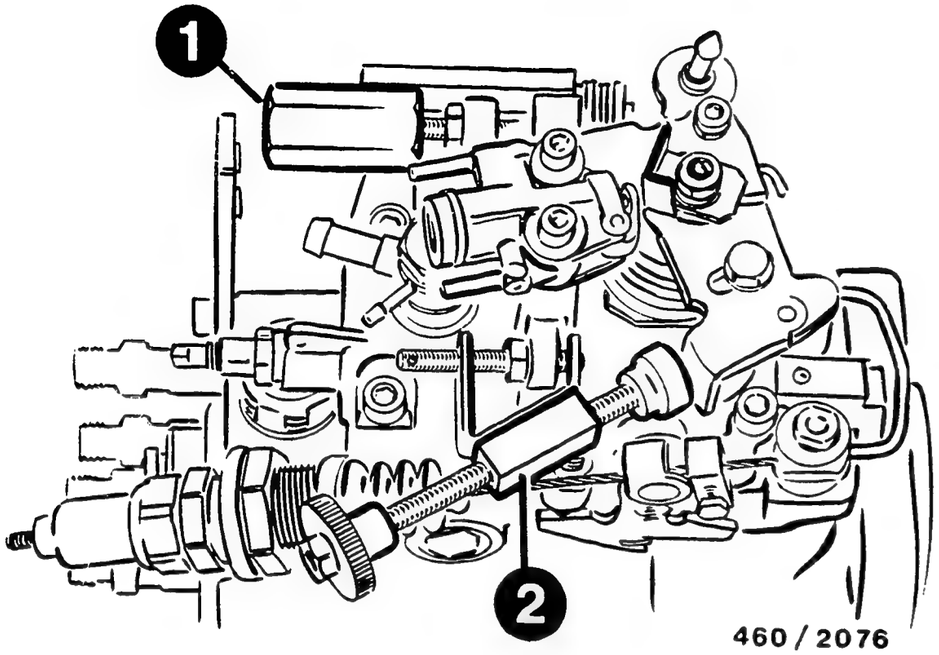
Measurement "2":

– Spacing (in accordance with test-specification sheet)

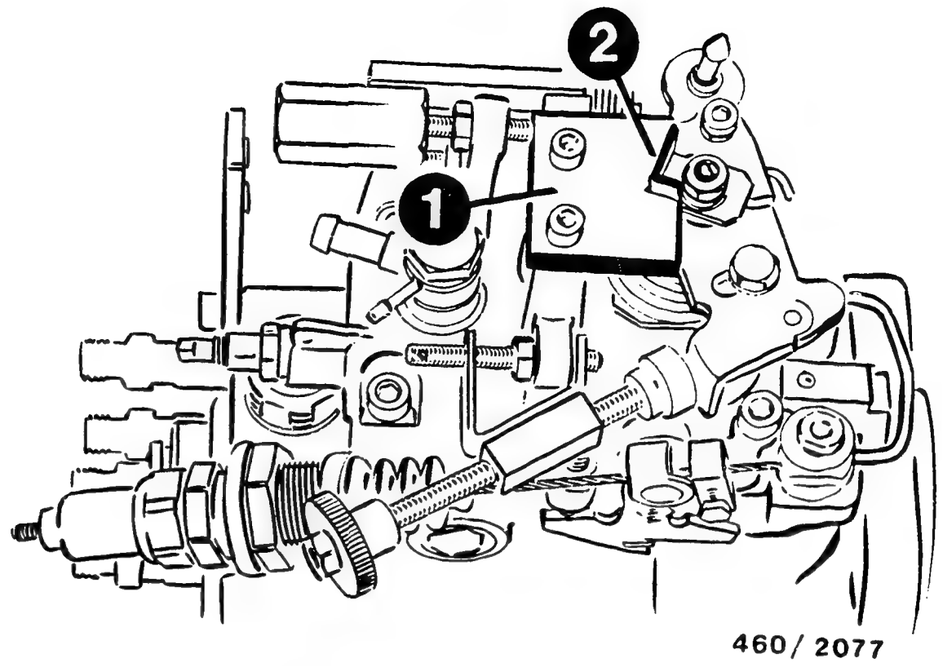
Make up difference with respect to 11.8 mm spacing by way of feeler gauge and – under same conditions as for measurement "1" – press speed-control lever against spacer.

Vacuum value 600 hPa.

If vacuum values are not obtained, check angle position of stop bracket.




1 = Spacer
2 = Adjusting screw




1 = Adjustment gauge
2 = Stop bracket

CHECKING AND ADJUSTING ANGLE POSITION

Remove switching valve.

Insert adjusting screw KDEP 1177 between speed-control lever and stop of rated-speed adjusting screw.

Push spacer KDEP 1176 with 11.8 mm spacing on to part-load-quantity adjusting screw.

Make up difference with respect to setting (in accordance with test-specification sheet).

Position speed-control lever against spacer piece of spacer by way of knurled screw.

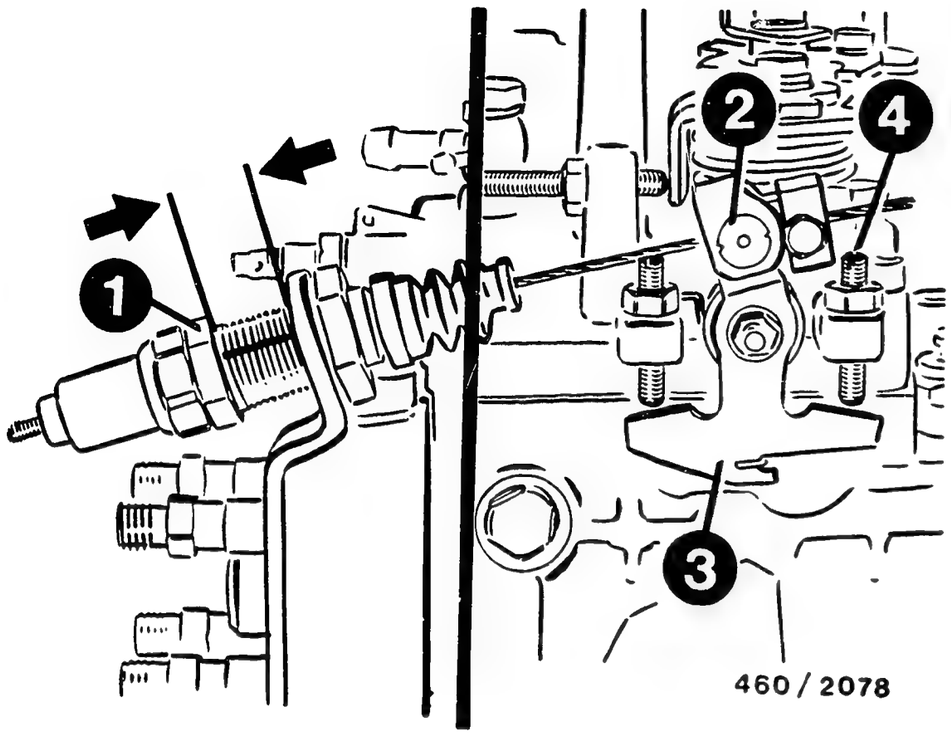
Fit adjustment gauge KDEP 1175 in place of switching valve and check angle position of stop bracket.

Adjust stop bracket (turn) if adjustment gauge cannot be fitted.

Loosen hexagon nut of stop bracket and turn stop bracket.

Remove adjustment gauge.

Fit switching valve and repeat switching-point adjustment.




460/2078

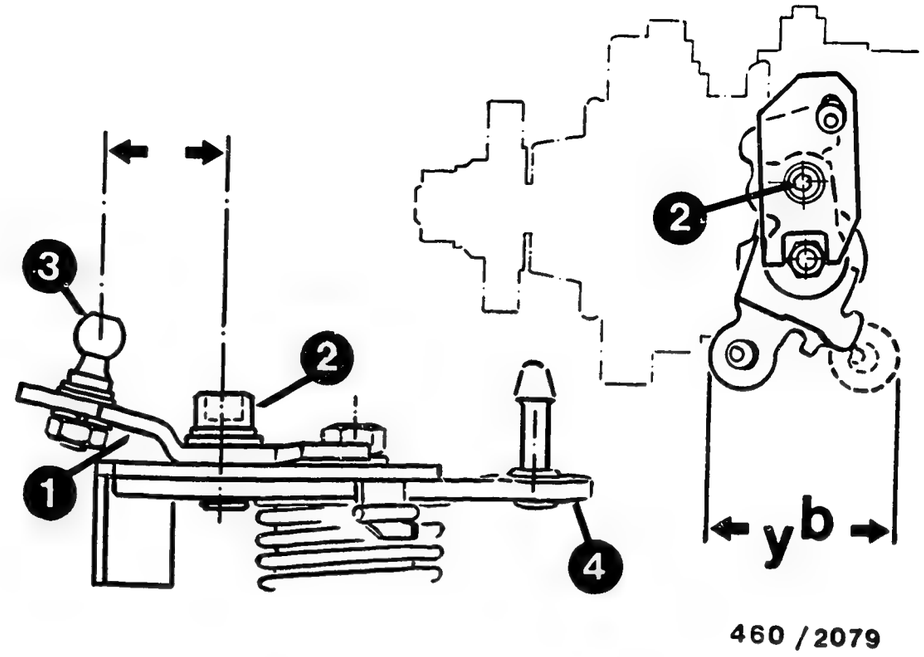
1 = Control housing
2 = Intermediate piece
3 = LFG stop lever
4 = Stop screw for high idle

ADJUSTING TEMPERATURE-CONTROLLED IDLE-SPEED INCREASE (TLA) ACTING ON HOUSING-FIXED IDLE SPRING (LFG)

Setting prerequisite:
- Pump completely adjusted

Screw control housing (thermocouple mount) into bracket until basic setting of 5.3...5.7 mm (distance between bracket and hexagon nut of control housing) is obtained.
Thread tie rod into intermediate piece.
Position LFG stop lever against high idle stop.
Thread clamping piece into tie rod, press clamping piece against LFG stop lever and tighten clamping screw to 3.5...4.5 Nm.






460/2079

1 = Lever for spring-actuated power on/off damper
2 = Fastening screw
3 = Ball stud
4 = Speed-control lever

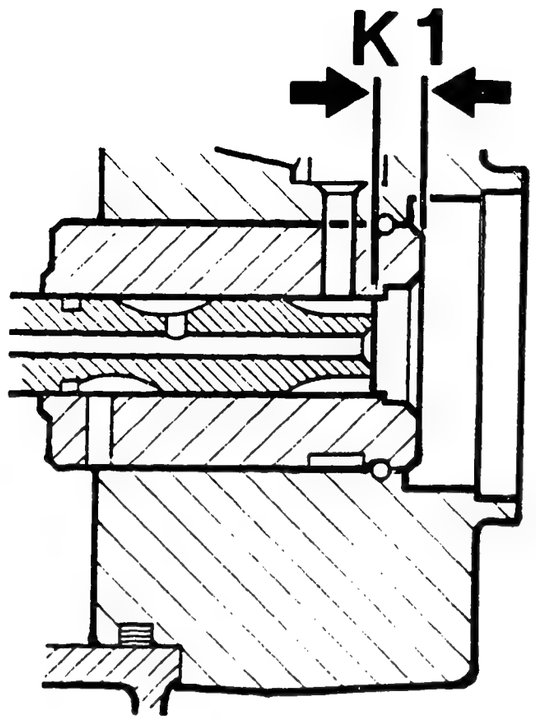
ATTACHING LEVER FOR SPRING-ACTUATED POWER ON/OFF DAMPER (FLD)

Fit lever for spring-actuated power on/off damper on speed-control lever.

Starting from idle stop, position speed-control lever against rated-speed stop.

Measure travel dimension Yb.

Measure distance between center of ball stud and center of fastening screw and set in accordance with dimension Yb.
Settings for ball stud in test-specification sheet
Tightening torque, ball stud 3...5 Nm.




460 / 2080

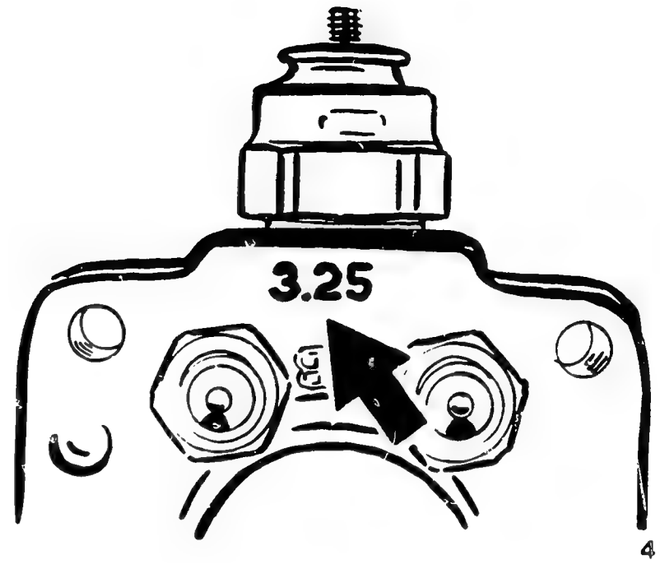
CHECKING QUIET-RUNNING FACILITY

- Check dimension "K1".

The dimension "K1" is the distance between the end-face sealing surface of the distributor head and the end face of the distributor-pump plunger.

Remove fuel-injection pump to check quiet-running-facility dimension "K1".



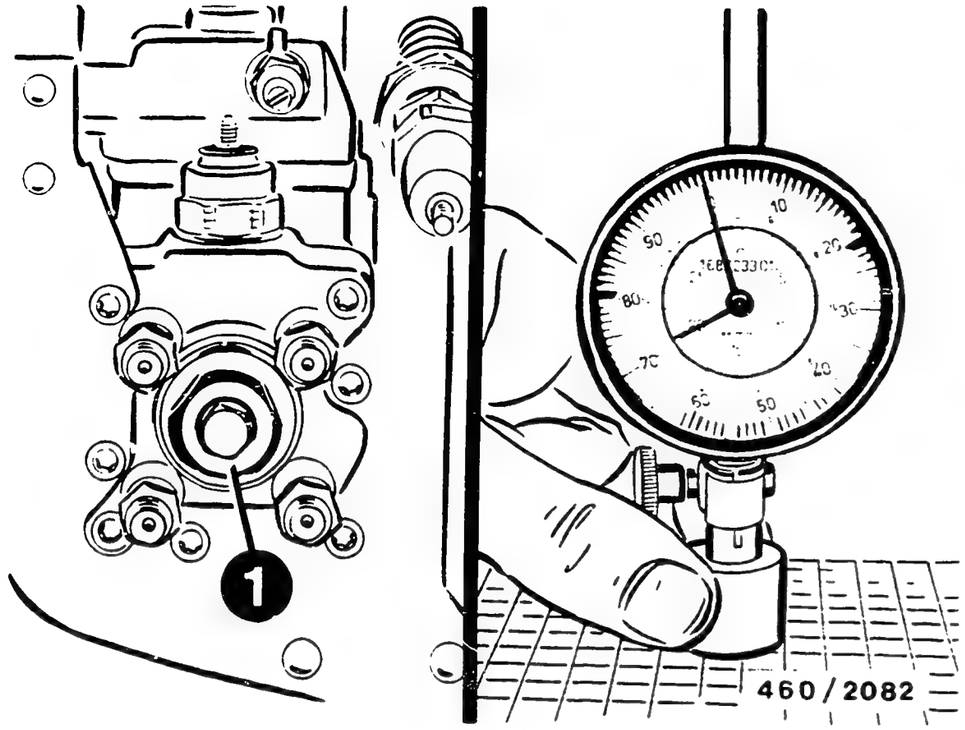



460/ 2081

The dimension "K1" is marked beneath the solenoid valve in the distributor head.

Example:

| | |
|---|---|
| Marked number | = 3.25 |
| Dimension "K1" | = 3.25 mm |
| Adjustment tolerance: | ± 0.015 mm |
| Check tolerance: | ± 0.030 mm |




1 = Central screw plug
2 = Dial-indicator holder

Attach distributor-type fuel-injection pump to clamping frame.
Attach drive coupling to injection-pump drive shaft.

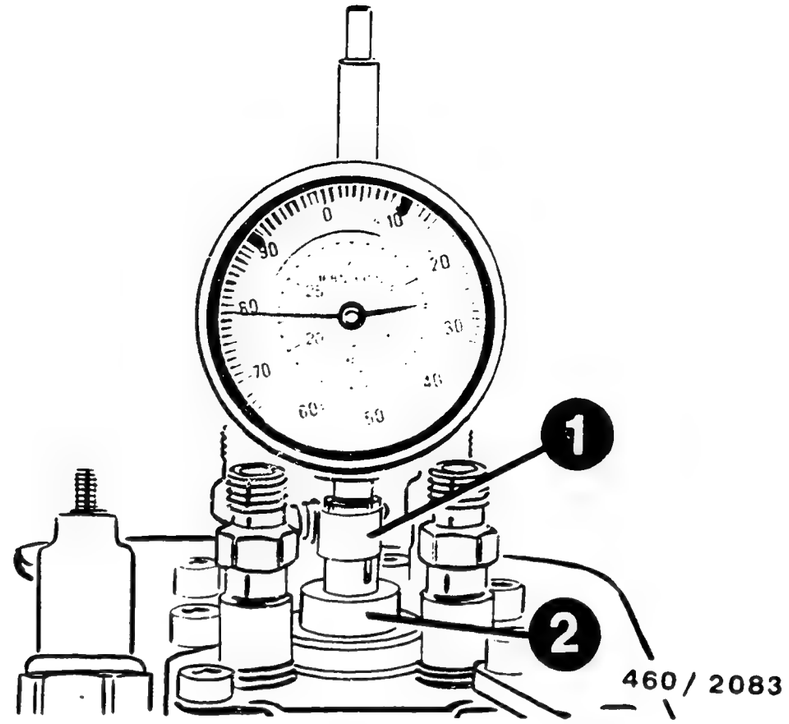
Remove central screw plug with wrench KDEP 1080.

Clamp dial indicator 1 687 233 012 with measuring element KDEP 1088/0/2 in position in dial-indicator holder KDEP 1088.

Position dial-indicator holder on marking plate such that it is flat, pre-tension dial indicator approx. 20 mm and set to "0".

Turn distributor-pump plunger to BDC position.






1 = Dial-indicator holder
2 = Centering sleeve KDEP 1088/0/3

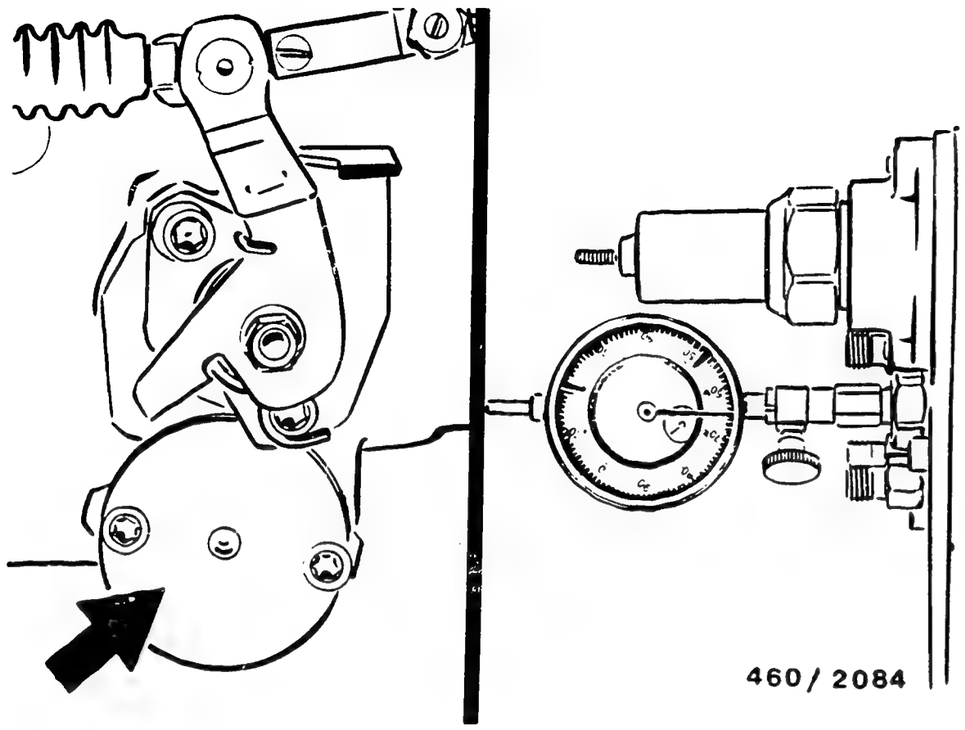
Insert dial-indicator holder with centering sleeve into distributor-head hole.

Compare measured dimension (red dial-indicator numbers) to desired dimension "K1" marked in distributor head.

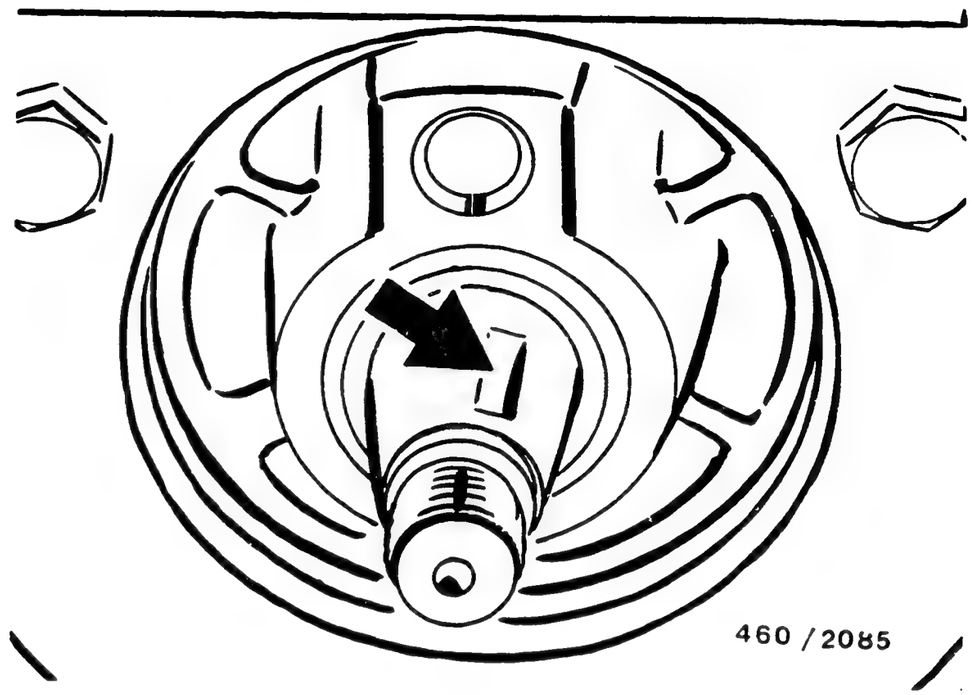
If the measured dimension is outside the tolerance, disassemble fuel-injection pump in accordance with repair instructions and adjust dimension "K1".

Screw new central screw plug with seal ring into distributor head using wrench KDEP 1088.

Tightening torque 70...90 Nm.




Arrow = Timing-device cover KDEP 1151
(Remove only in the case of pumps with HBA)




Arrow = Keyway

SETTING LOCKED TIMING IN ACCORDANCE WITH PLUNGER LIFT

- Pumps with and without HBA

Remove original timing-device cover on delivery end.

Fit timing-device cover KDEP 1151 in line with pump version on delivery end.
Remove bleeder screw.

Insert woodruff key into keyway of drive shaft.

Push drive coupling on to drive shaft.
Attach plunger-lift measuring device KDEP 1085 and set dial indicator to "zero" in BDC position of distributor-pump plunger.



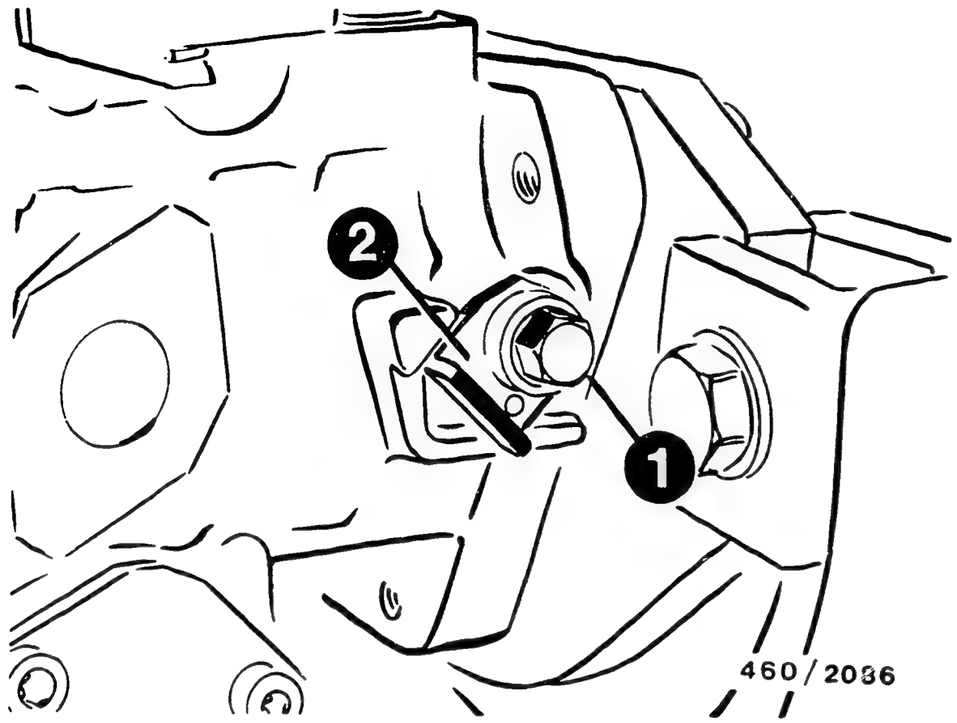
Turn pump drive shaft in direction of pump rotation until drive-shaft keyway points towards relevant outlet on distributor head.

Slowly continue turning drive shaft until setting is obtained.

Setting for relevant outlet is given in test-specification sheet under locked timing.

N o t e :

Adjust setting to upper tolerance limit.



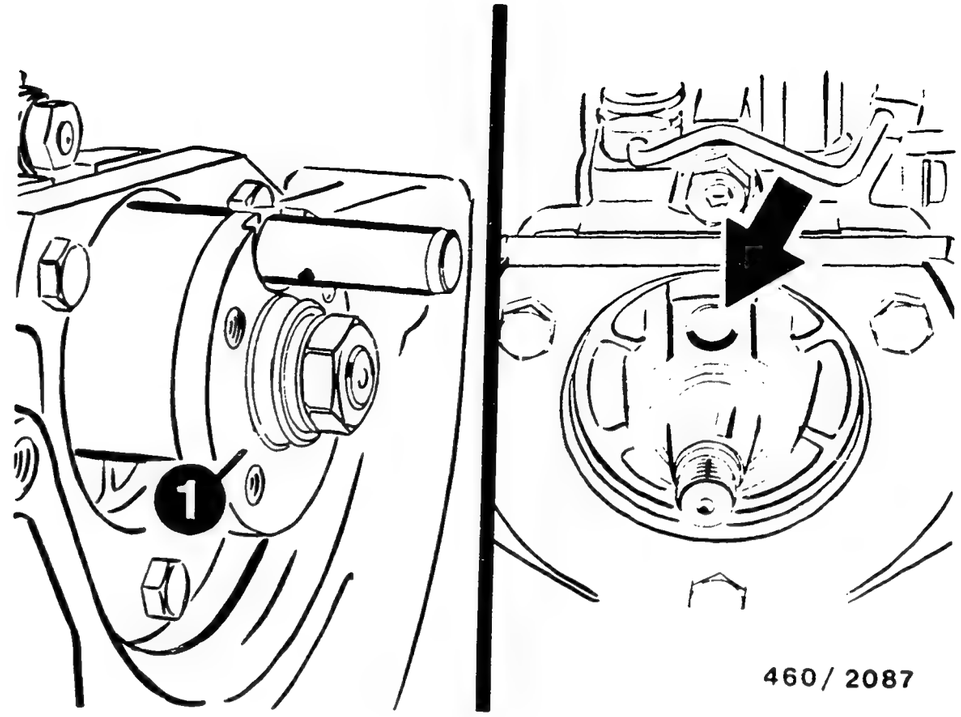

1 = Locking screw
2 = Support plate

Repeat adjustment procedure if set value is exceeded.
Remove support plate of locking screw and secure with locking wire at control lever.

Screw in locking screw and block drive shaft.
Tightening torque of locking screw 27...35 Nm.

Observe set value whilst blocking drive shaft.
Should set value deviate, repeat adjustment procedure.
Remove plunger-lift measuring instrument and screw in bleeder screw with new gasket.






1 = Coupling half

FITTING COUPLING HALF

Remove drive coupling.
Do not turn drive shaft in doing so.
Clean tapered surfaces (free of grease and dirt).
Fit coupling half and turn until setting mandrel KDEP 1173 can be inserted through coupling half into setting hole (arrow).
Attach lock nut to coupling half and tighten to pre-tightening torque 30 Nm.
C a u t i o n :
Do not counterhold coupling half in setting hole by means of setting pin.
Loosen locking screw.
Fit support plate beneath locking screw and tighten to 27...35 Nm.
Counterhold drive shaft and tighten lock nut.

| | |
|---|---|
| Hexagon nut | 90...95 Nm |
| Flat nut | 70...75 Nm. |

Instructions : W-460/307

BOSCH system : Load-dependent start of delivery (LFB) for VE distributor-type fuel-inj. pump

Basic microcard : W-400/012

Section | Coordinates





## SPECIAL FEATURES

This microcard deals with testing and adjustment of VE pumps with:
- load-dependent start of delivery (LFB)

It is based on the detailed test instructions (see W-400/00.. "Testing VE..F.. Instructions").

In the case of distributor-type fuel-injection pumps VE..F.. with load-dependent start of delivery, the LFB setting changes if - on the test-specification sheet under "Load-dependent start of delivery" - there is not only an indication of speed, but also data concerning LFB timing-device travel and LFB quantity.

## TESTERS AND TOOLS

| | |
|---|---|
| Adjustment tool | KDEP 1082 |
| Adjustment tool | KDEP 1181 |

## TIGHTENING TORQUES

| | |
|---|---|
| Lock nut of governor shaft | 22...30 Nm |
| Hexagon nut of idle stop | 6... 9 Nm |

## NOTES ON MODIFIED LFB SETTING

* Set pump in accordance with basic instructions (see W-400/00.. "Testing VE..F.. Instructions") as far as item "Pump with load-dependent start of delivery".

* Do not set idle breakaway or residual quantity (only in the case of pumps with housing-fixed idle spring - LFG).

* Prior to actual LFB adjustment, it must be ensured that the fuel-injection pump/cold-start accelerator (KSB) have assumed the status for an engine at operating temperature.



## ADJUSTMENT SEQUENCE FOR LOAD-DEPENDENT START OF DELIVERY (LFB)

Set LFB speed in accordance with test-specification sheet on test bench (control lever on max. speed stop).

Measure and note down delivery.

Measure and note down timing-device travel.

Move speed-control lever in direction of idle stop until there is a reduction in delivery (LFB quantity). Hold speed-control lever in this position by means of idle stop screw.

Turn governor shaft until timing-device travel (LFB-SV travel) indicated on test-specification sheet is attained.

Lock governor shaft with adjustment tool KDEP 1082, KDEP 1181 or open-ended wrench. In doing so, counter-hold governor shaft with Allen wrench.
Tighten lock nut to tightening torque of 22...30 Nm.

Re-check timing-device travel set.

Set idle breakaway/residual quantity.

Continue with pump test sequence in accordance with basic instructions (see W-400/00.. "Testing VE..F.. Instructions").

Instructions : W-460/308

BOSCH system : Mechanical shutoff for VE distributor-type fuel-injection pump

Basic microcard : W-400/00..





## SPECIAL FEATURES

This microcard describes setting the mechanical shutoff on VE distributor-type fuel-injection pumps.

It is based on the detailed repair instructions (see W-400/00.. repair VE..F.. instructions).
When adjusting the mechanical shutoff, the stop lever must be set with a specific assignment with respect to the setting shaft (control lever).

The various shutoff devices can be distinguished from the shape of the stop lever or the shape of the control lever.

## TEST SPECIFICATIONS

Version 1.1. – Standard version
– Dimension b 19.3 mm

Version 1.2. – Special version A
– Dimension b 20.3 mm
– Dimension d max. 2.0 mm

Version 1.3. – Special version B
– Dimension b 20.3 mm
– Dimension d max. 2.0 mm

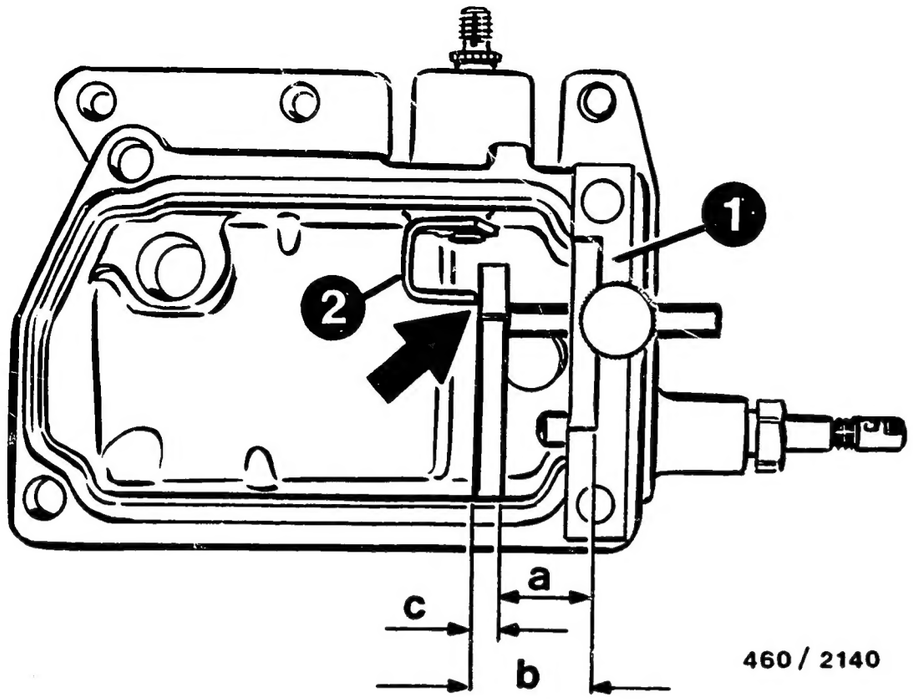
Version 2.1. – Negative torque control
– Dimension b 28.8 mm

## TESTERS AND TOOLS

| | |
|---|---|
| Caliper gauge | commercially available |
| Feeler gauge | KDEP 1152/3 |

## TIGHTENING TORQUES

| | |
|---|---|
| Hexagon nut, setting shaft | 5...10 Nm |
| Lock nut, stop screw | 6... 9 Nm |




1 = KDEP 1152/3
2 = Control lever

1. Control lever setting

Applies to versions 1.1. 1.2. 1.3.

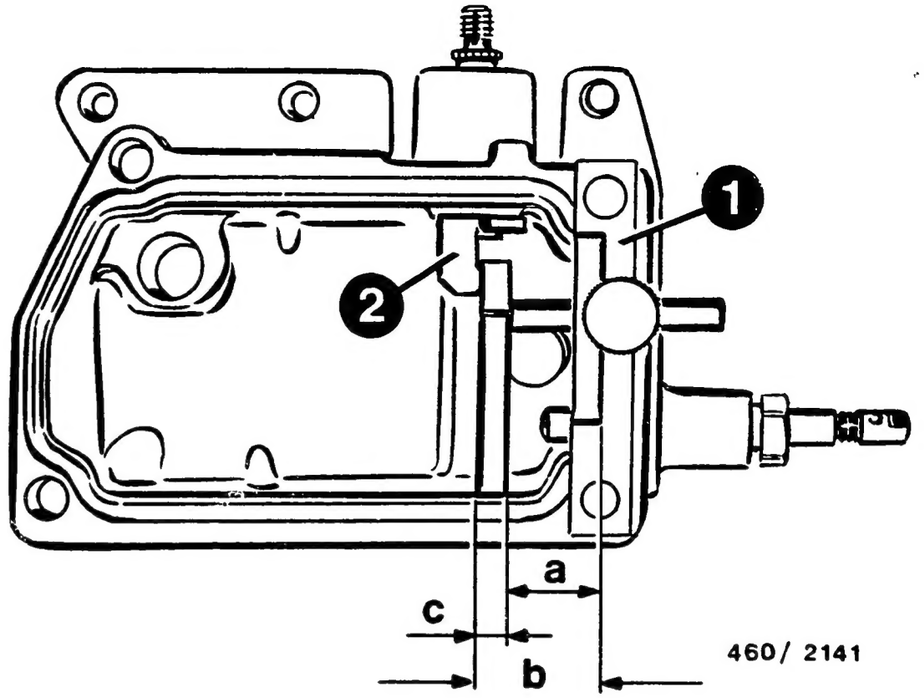
Attach KDEP 1152/3 to housing cover; determine and note down dimension "c" (thickness of measuring jaw).

Take dimension "b" from following version sheets.

Calculate dimension "a" (a=b–c) and set measuring jaw to this dimension.

Clamp KDEP 1152/3 in this position and press control lever against measuring jaw (arrow).






1 = KDEP 1152/3
2 = Control lever

2. Control lever setting

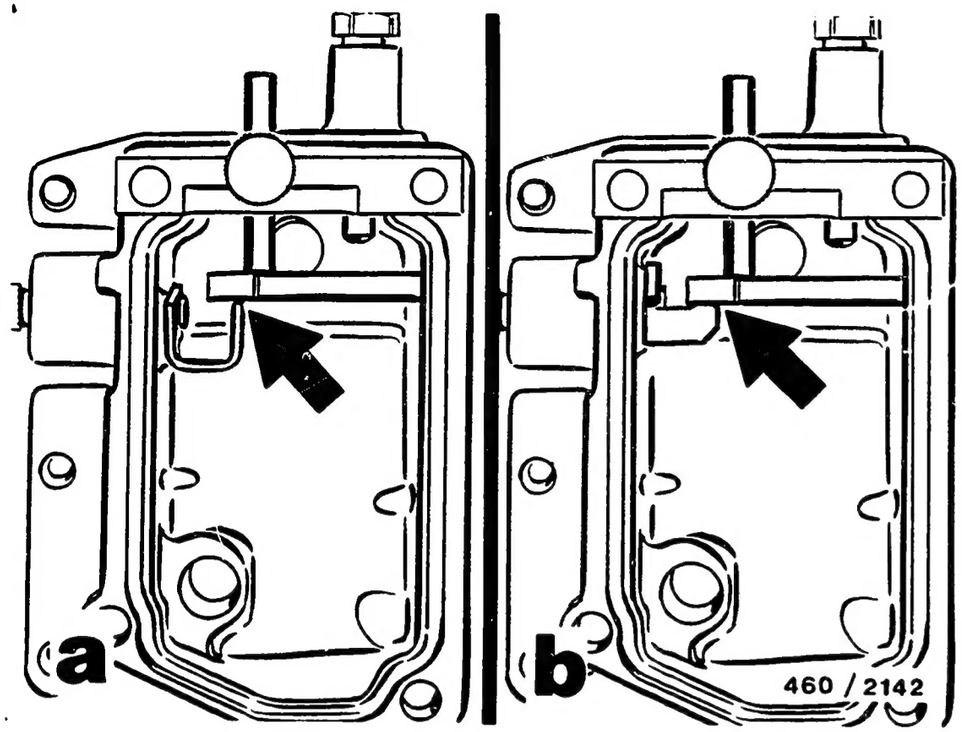
Applies to version 2.1.

Attach KDEP 1152/3 to housing cover; determine and note down dimension "c" (thickness of measuring jaw).

Take dimension "b" from following version sheets.

Calculate dimension "a" (a=b–c) and set measuring jaw to this dimension.

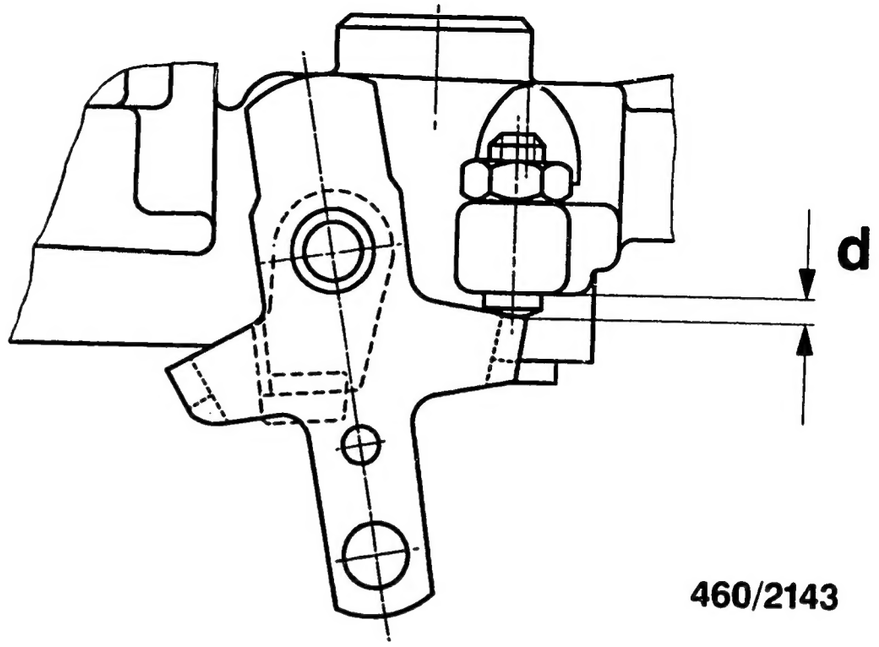
Clamp KDEP 1152/3 in this position and press control lever against measuring jaw (arrow).




NOTE ON STOP LEVER SETTING

With all subsequent operations, care is to be taken to ensure that the control lever makes contact with the measuring jaw of KDEP 1152/3 (picture a and b – arrow).






1.1. Stop lever – standard version

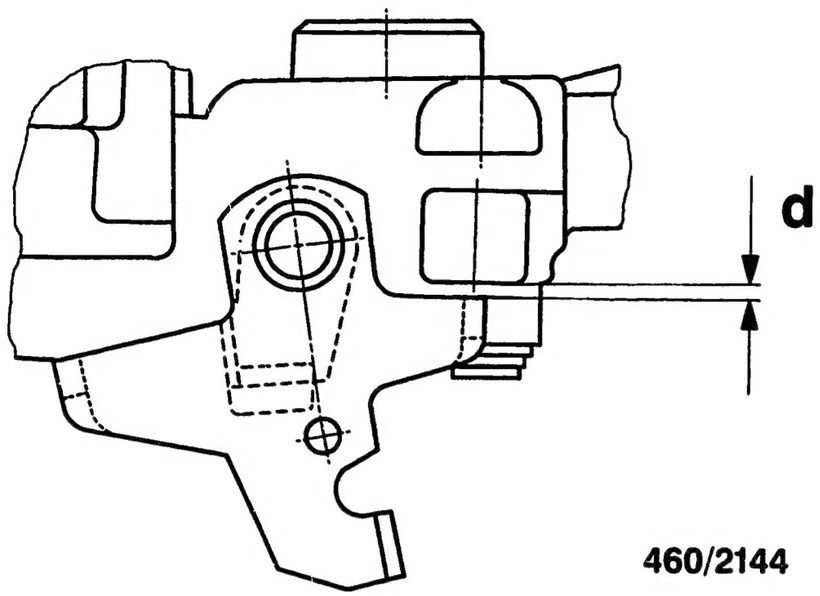
Dimension "b" = 19.3 mm.

Position stop lever on setting shaft such that dimension "d" between lever stop and cast stop is as small as possible.

Place spring in position.

Press stop lever in direction of cast stop and at the same time tighten hexagon nut on setting shaft to tightening torque 5...10 Nm.

Position stop screw on stop lever (dimension "d") and tighten lock nut to tightening torque 6...9 Nm.




460/2144

1.2. Stop lever – special version A

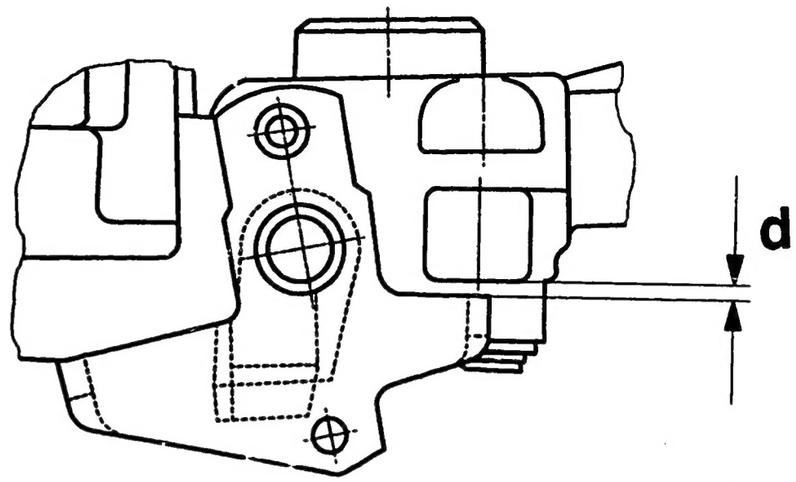
Dimension "b" = 20.3 mm.

Position stop lever on setting shaft such that dimension "d" between lever stop and cast stop is max. 2 mm.
Should dimension "d" = max. 2 mm not be attained, dimension "b" is to be slightly reduced.

Place spring in position.

Press stop lever in direction of cast stop and at the same time tighten hexagon nut on setting shaft to tightening torque 5...10 Nm.






460/2145

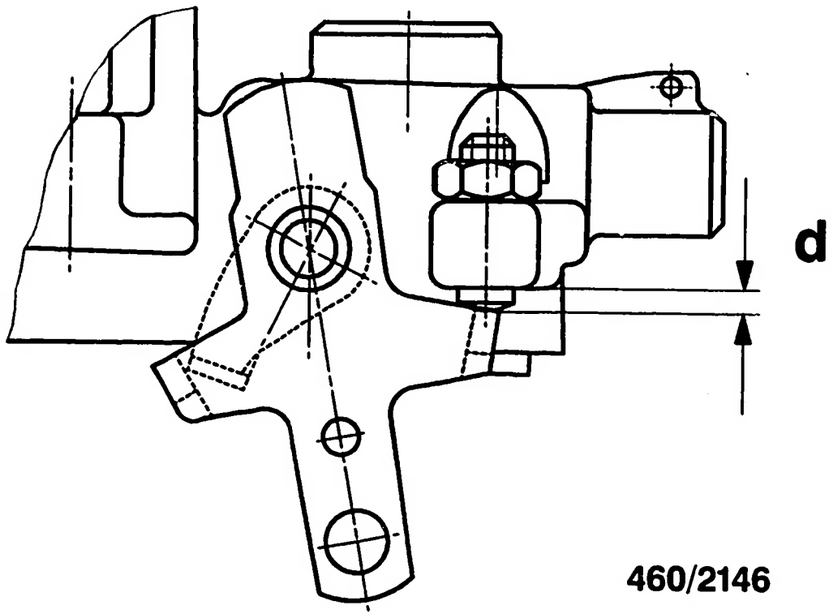
1.3. Stop lever – special version B

Dimension "b" = 20.3 mm.

Position stop lever on setting shaft such that dimension "d" between lever stop and cast stop is max. 2 mm.
Should dimension "d" = max. 2 mm not be attained, dimension "b" is to be slightly reduced.

Place spring in position.

Press stop lever in direction of cast stop and at the same time tighten hexagon nut on setting shaft to tightening torque 5...10 Nm.




2.1. Stop lever – negative torque control

Dimension "b" = 28.8 mm.

Position stop lever on setting shaft such that dimension "d" between lever stop and cast stop is as small as possible.

Place spring in position.

Press stop lever in direction of cast stop and at the same time tighten hexagon nut on setting shaft to tightening torque 5...10 Nm.

Position stop screw on stop lever (dimension "d") and tighten lock nut to tightening torque 6...9 Nm.

For production reasons: continued on the following coordinate.